EXHIBIT A

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

IN RE: ETHICON, INC. PELVIC REPAIR SYSTEM PRODUCTS LIABILITY LITIGATION **THIS DOCUMENT RELATES TO:** ***All Wave 5 Cases***	**Master File No. 2:12-MD-02327** **MDL No. 2327** **JOSEPH R. GOODWIN** **U.S. DISTRICT JUDGE**

GENERAL RETAINED EXPERTS

1) Dr. Bruce Rosenzweig (Urogynecologist)
Rush University Professional Building
1725 West Harrison Street, Suite 358
Chicago, IL 60612

2) Dr. Daniel Elliott (Urologist)
Mayo Clinic
200 1st Street SW
Rochester, MN 55902

3) Dr. Jerry Blaivas (Urologist) (adoption of previously served reports)
445 East 77th Street
New York, NY 10075

4) Dr. Ralph Zipper (Urogynecologist) (adoption of previously served report)
Zipper Urogynecology
1130 S. Harbor City Boulevard
Melbourne, FL 32901

5) Dr. Robert Shull (Urogynecologist) (adoption of previously served report)
Scott & White Clinic & Hospital
Department of Obstetrics and Gynecology
2401 S. 31st Street
Temple, Texas 76508

6) Dr. Abbas Shobeiri (Urogyn) (adoption of previously served report)
500 North Washington St
300
Falls Church, VA 22046

7) Dr. Vladimir Iakovlev, M.D. (Pathologist) (adoption of previously served report)
St. Michael's Hospital, Division of Pathology
30 Bond Street, Cardinal Carter, Room 2-093
Toronto, ON, M5B1W8
CANADA

8) Dr. Paul Michaels (Pathologist) (adoption of previously served report)
Austin, TX

9) Prof. Dr. med. Uwe Klinge (Materials) (adoption of previously served report)
KLINIK FÜR ALLGEMEIN-, VISZERAL- UND
TRANSPLANTATIONSCHIRURGIE
RWTH Aachen und Universitätsklinikum Aachen
Pauwelsstraße 30
D-52074 Aachen
Germany

10) Prof. Dr.-Ing. Thomas Muehl (Materials) (adoption of previously served report)
FH Aachen - University of Applied Sciences
Labor für Elektrische Messtechnik und Prozessdatenverarbeitung
Eupener Str. 70
52066 Aachen
Germany

11) Dr. Howard Jordi (Materials) (adoption of previously served report)
Jordi Labs
200 Gilbert Street
Mansfield, MA 02048

12) Dr. Scott Guelcher (Materials)
Polymer and Chemical Technologies, LLC
1008 Caldwell Avenue
Nashville, TN 37204

13) Dr. Jimmy Mays (Materials)
Department of Chemistry
University of Tennessee at Knoxville
655 Buehler Hall
Knoxville, TN 37996

14) Dr. Russell Dunn (FMEA) (adoption of previously served report)
Polymer and Chemical Technologies, LLC
1008 Caldwell Avenue
Nashville, TN 37204

15) Dr. Dionysios Veronikis (Urogyn) (adoption of previously served report)
St. Johns Mercy Medical Center
Tower B
621 S New Ballas Rd
#2002-B
St. Louis, MO 63141

16) Dr. Michael Thomas Margolis (Urogyn)
Bay Area Pelvic Surgery
1820 Ogden Dr.
Burlingame, California 94010

17) Dr. Anne Wilson (FMEA) (adoption of previously served report)
QA Consulting, Inc.
7500 Rialto Blvd.
Bldg. 1, Ste. 225
Austin, Tx 78735

18) Dr. John Miklos (Urogyn) (adoption of previously served report)
3400 Old Milton Parkway
Bldg. C, Suite 330
Alpharetta, GA 30005

19) Dr. Neeraj Kohli (Urogyn) (adoption of previously served report)
70 Walnut St
Wellesley, MA 02481

20) Dr. Alan Garely (Urogyn) (adoption of previously served report)
1 S Central Ave
Valley Stream, NY 11580

21) Dr. Brian Raybon (Urogyn) (adoption of previously served report)
79 Doyle St
Toccoa, GA 30577

22) Dr. Robert Moore (Urogyn) (adoption of previously served report)
3400 Old Milton Pkwy
Alpharetta, GA 30005

23) Dr. Donald R. Ostergard (Urogyn)
8557 Mountain View Farms Ln
Salida, CO 81201

24) Duane Priddy, Ph.D. (Materials) (adoption of previously served report)
Plastic Failure Labs
6004 Camelot Ct
Midland, MI 48640

25) Dr. Anne M. Weber (Urogynecologist) (adoption of previously served report)
5626 Sharon Drive
Glen Arm, MD 21057

GENERAL RETAINED REGULATORY EXPERTS

Plaintiffs recognize that the Fourth Circuit has affirmed Judge Goodwin's decision to exclude evidence relating to a manufacturer's compliance with the FDA's 510(k) process. In the event of a contrary ruling, Plaintiffs reserve the right to designate the following General Regulatory Experts:

1) Dr. Peggy Pence (Regulatory) Dr. Peggy Pence (Regulatory) (adoption of previously served reports)
Symbion Research International, Inc.
3537 Old Conejo Road, Suite 115
Newbury Park, CA 91320

2) Dr. Suzanne Parisian (Regulatory) (adoption of previously served report)
MD Assist, Inc.
7117 N. 3rd Street
Phoenix, AZ 85020

EXHIBIT B

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
AT CHARLESTON

IN RE ETHICON, INC., PELVIC REPAIR SYSTEM PRODUCTS LIABILITY LITIGATION	**Master File No. 2:12-MD-02327** **MDL 2327**
THIS DOCUMENT RELATES TO CASE: **WAVE 5 CASES**	**JOSEPH R. GOODWIN** **U.S. DISTRICT JUDGE**

SECOND AMENDED NOTICE OF DEPOSITION OF DR. SCOTT A. GUELCHER

TO: ALL COUNSEL OF RECORD

PLEASE TAKE NOTICE that the deposition of **SCOTT GUELCHER** will take place on August 17, 2017 at 9:00 a.m. CST, at Butler Snow LLP, Nashville Conference Room, 150 3rd Ave., South, Suite 1600, Nashville, Tennessee 37201, (615) 651-6700.

PLEASE FURTHER TAKE NOTICE that the undersigned attorneys for defendants Ethicon, Inc. and Johnson & Johnson in accordance with Rule 30 of the Federal Rules of Civil Procedure, the procedures set forth in *In Re: Ethicon Inc., Pelvic Repair System Products Liability Litigation*, MDL No. 2327, Defendants Ethicon Inc. and Johnson & Johnson hereby notice this deposition for any and all purposes permitted by the rules of the MDL Court, and any other state or local rules that apply to this action. Defendants Ethicon, Inc. and Johnson & Johnson further state that this deposition shall be conducted in accordance with and subject to the Protective Order entered in the above-referenced action and the Protective Order in *In Re: Ethicon Inc., Pelvic Repair System Products Liability Litigation*, MDL No. 2327

PLEASE TAKE FURTHER NOTICE that said deposition shall take place before a duly qualified Notary Public authorized to administer oaths and shall continue from day to day until completed. Said deposition shall cover all matters relevant to the subject matter of the within action.

PLEASE TAKE FURTHER NOTICE that the person to be examined is required to produce any document reviewed by the deponent, prior to the commencement of the deposition, to prepare for the deposition and/or to refresh the deponent's recollection regarding the facts of this case, as well as all documents requested on Schedule A.

Dated: August 14, 2017

Respectfully submitted,

/s/ David B. Thomas
David B. Thomas (W. Va. Bar #3731)
Thomas Combs & Spann PLLC
300 Summers Street
Suite 1380 (25301)
P.O. Box 3824
Charleston, WV 25338
(304) 414-1807
dthomas@tcspllc.com

/s/ Christy D. Jones
Christy D. Jones (MS Bar #3912)
Butler Snow LLP
1020 Highland Colony Parkway
Suite 1400
Ridgeland, MS 39157
P.O. Box 6010
Ridgeland, MS 39158-6010
(601) 985-4523
Christy.jones@butlersnow.com

COUNSEL FOR DEFENDANTS ETHICON, INC. AND JOHNSON & JOHNSON

EXHIBIT A
DEFINITIONS

1. "You" or "Your" refers to the witness, SCOTT GUELCHER.

2. "Plaintiff" refers to each of the Plaintiffs referenced in the above styled litigation.

3. The word "and" and the word "or" shall, where the context permits, be construed to mean "and/or."

4. The terms "relating to" and "related to" mean in whole or in part or in any way constituting, containing, concerning, embodying, evidencing, reflecting, describing, analyzing, identifying, stating, dealing with, referring to or pertaining to.

5. Words used in the singular shall, where the context permits, include the plural, and words used in the plural shall, where the context permits, include the singular.

6. The use of a verb tense shall be construed as the use of that verb in all other tenses.

7. The term "Communication," as used in these Requests, is intended to have the broadest possible meaning and shall include any contact or act by which information or knowledge is transmitted or conveyed between two or more persons and includes, without limitation: (1) written contact, including but not limited to letters, memoranda, PowerPoint presentations, email, text message, telegram, telex, internet-based meetings, or other written or electronic Document or files; (2) oral contact, whether by face-to-face meetings, internet-based meetings, video conferences, telephonic conversations, or otherwise; and (3) nonverbal acts intended to communicate or convey any meaning, understanding or other message.

8. As used throughout, "Document" means any written or graphic matter however produced or reproduced. "Document" also includes writings of every kind, source, and authorship, both originals and all non-identical copies thereof, in Your possession, custody, or

control, or known by You to exist, irrespective of whether the writing is one intended for or transmitted internally by You, or intended for or transmitted to any other person or entity, including without limitation any government agency, department, administrative entity, or personnel. The term shall include handwritten, typewritten, printed, photocopied, photographic, or recorded matter. It shall include communications in words, symbols, pictures, sound recordings, films, tapes, and information stored in, or accessible through, computer or other information storage or retrieval systems, together with the codes and/or programming instructions and other materials necessary to understand and use such systems. For purposes of illustration and not limitation, the term shall include: correspondence; transcriptions of testimony; letters; notes; reports; papers; files; books; records; contracts; agreements; telegrams; teletypes and other communications sent or received; diaries; calendars; logs; circulars; announcements; advertisements; instructions; schedules; minutes; summaries; notes and other records and recordings of any conferences, meetings, visits, statements, interviews, or telephone conversations; bills; statements and other records of obligations and expenditures; canceled checks; vouchers; receipts and other records of payments; ledgers; journals; balance sheets; profit and loss statements; interviews; affidavits; printed matter (including published books, articles, speeches, and newspaper clippings); press releases; charts; drawings; specifications; manuals; brochures; parts lists; memoranda of all kinds to and from any persons, agencies, or entities; technical and engineering reports; evaluations; advises; recommendations; commentaries; conclusions; studies; test plans; procedures; data; reports, results, and conclusions; records of administrative, technical, and financial actions taken or recommended; and all other materials the contents of which relate to, discuss, consider, or otherwise refer to the subject matter of the particular discovery requested. “Document” also means and includes all

original and non-identical copies of any papers, books, accounts, writings, drawings, graphs, charts, photographs, phone-records, recordings or other data compilations from which information can be obtained, translated, if necessary, by You through detection devices into reasonably usable form, and tangible things. These terms also include any communications passing between Your agents, representatives, or employees.

DOCUMENT REQUESTS

1. All Documents and Communications (including but not limited to (i) protocols, (ii) interim and final results, (iii) raw data, (iv) supplemental data, (v) reports of adverse events, (vi) informed consents, (vii) investigator brochures, (viii) publications and submissions, (ix) materials and minutes for any study meeting, (x) information regarding specimens and materials, and (xi) communications with co-authors, patients, health authorities, sponsors, investigators, or institutional review boards) relating to A.D. Talley, B.R. Rogers, V. Iakovlev, R.F. Dunn, and S.A. Guelcher, *Oxidation and Degradation of Polypropylene Transvaginal Mesh*, J. of Biomaterials Sci: Polymer Ed. (2017).

2. All Documents and Communications (including but not limited to (i) protocols, (ii) interim and final results, (iii) raw data, (iv) supplemental data, (v) reports of adverse events, (vi) informed consents, (vii) investigator brochures, (viii) publications and submissions, (ix) materials and minutes for any study meeting, (x) information regarding specimens and materials, and (xi) communications with co-authors, patients, health authorities, sponsors, investigators, or institutional review boards) relating to any other study, analysis, test, clinical trial or epidemiological study concerning polypropylene or Prolene in which you participated in any capacity, including as an investigator, safety monitor, advisor, or study committee member.

3. All Documents and Communications (including but not limited to (i) protocols, (ii) interim and final results, (iii) raw data, (iv) supplemental data, (v) reports of adverse events, (vi) informed consents, (vii) investigator brochures, (viii) publications and submissions, (ix) materials and minutes for any study meeting, (x) information regarding specimens and materials, and (xi) communications with co-authors, patients, health authorities, sponsors, investigators, or institutional review boards) relating to any study, analysis, test, clinical trial or epidemiological study concerning hernia mesh, pelvic mesh, pelvic organ prolapse, or stress urinary incontinence—regardless as to the material from which the mesh was made—in which you participated in any capacity, including as an investigator, safety monitor, advisor, or study committee member.

4. All Documents and Communications relating to any publications, proposed publications, or draft submissions for publication authored by you relating to polypropylene or Prolene.

5. All Documents and Communications relating to any publications, proposed publications, or draft submissions for publication authored by you relating to pelvic mesh, pelvic organ prolapse, or stress urinary incontinence.

6. All Documents and Communications relating to presentations or lectures given or contributed to by you which concerned polypropylene or Prolene.

7. All Documents and Communications relating to presentations or lectures given or contributed to by you which concerned pelvic mesh, pelvic organ prolapse, or stress urinary incontinence.

8. All Documents, including but not limited to calculations, correspondence, data, calendar entries, notes and other materials, reflecting the compensation to be paid to You for study and testimony in this case.

9. All Documents, including but not limited to calculations, correspondence, data, calendar entries, notes and other materials, reflecting the compensation a) paid to You to date; and b) due to be paid to You once a bill is prepared for Your study and testimony, in connection with providing expert opinions in any pelvic mesh litigation in the last four years, in which You have been submitted a report and/or been disclosed as an expert witness for a plaintiff.

10. A copy of an up-to-date Curriculum Vitae.

11. If not included in Your up-to-date Curriculum Vitae, a complete list of Your publications, including but not limited to treatises, articles, journals, editorials, texts, abstracts, CLE or CME materials, PowerPoints, and seminar materials.

12. A complete list of all other cases in which You have testified as an expert or by deposition in the last four years.

13. Copies of any deposition testimony relating to this case in Your possession.

14. All Documents, including but not limited to graphics, testing, recordings, spreadsheets, databases, data in any other form, work papers, and notes, whether preliminary or final, prepared by or at Your direction reflecting facts, factual assessments or assumptions, beliefs, or medical information regarding Plaintiffs relating to Your opinions in this litigation.

15. All Documents, including but not limited to graphics, testing, recordings, spreadsheets, databases, data in any other form, work papers, and notes, whether preliminary or final, prepared by or at Your direction reflecting facts, factual assessments or assumptions, or beliefs relating to any other pelvic mesh cases.

16. Any and all Documents relating to or reflecting any communication involving You and any of the Plaintiff's other experts, including but not limited to other experts' disclosures, reports, or deposition testimony that You have been provided.

17. Any and all Documents, records, literature and data or information of any kind reviewed or considered by or made available to You, whether You did or did not rely on such Documents, records, literature and data or information.

18. All literature, published or unpublished, consulted by You in connection with Your opinions in this litigation, including all literature that supports or fails to support Your opinions.

19. All depositions, pleadings, court opinions, or other records that were summarized for You or otherwise made available for Your review in connection with Your expected testimony in this litigation or in any pelvic mesh case.

20. All graphics or charts prepared by You or at Your direction for use at deposition and/or trial in this case.

21. Any Ethicon products in Your possession or Ethicon products belonging to You that You have placed in the possession of others.

22. All communications from or to You relating to any professional society with respect to pelvic mesh, pelvic mesh products, pelvic organ prolapse, stress urinary incontinence, position statements, studies, editorials, and/or publications.

23. Copies of any letters, brochures, promotions, websites, or other Documents in which You advertise or discuss Your work or availability as an expert or consultant in litigation.

24. Copies of the syllabus and texts used in any classes taught by You in the past five years.

25. All transcripts of prior testimony, statements or presentations given by You in any proceeding before the Food and Drug Administration, the Drug Enforcement Agency, the United States House of Representatives, Wall Street, Financial Analysis, national Pharmaceutical Association Meetings, and on local or national television.

26. A copy of Your complete file in this litigation.

27. Any communications between You and counsel for the Plaintiff, to the extent that such communications:

    a. Relate to Your compensation;

    b. Identify facts or data that You were provided and that You considered in forming Your opinions; or

    c. Identify assumptions that Plaintiff's counsel provided You and that You relied on in forming Your opinions.

CERTIFICATE OF SERVICE

I hereby certify that August 14, 2017, I electronically filed the foregoing document with the Clerk of the Court using the CM/ECF system which will send notification of such filing to CM/ECF participants registered to receive service in this MDL.

/s/ David B. Thomas
David B. Thomas (W. Va. Bar No. 3731)
Thomas Combs & Spann, PLLC
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COUNSEL FOR DEFENDANTS ETHICON, INC. AND JOHNSON & JOHNSON

EXHIBIT C

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

IN RE: ETHICON, INC. PELVIC REPAIR SYSTEMS PRODUCTS LIABILITY LITIGATION	**Master File No. 2:12-MD-02327** **MDL 2327** **JOSEPH R. GOODWIN** **U.S. DISTRICT JUDGE**
THIS DOCUMENT RELATES TO: **WAVE 5 CASES**	

RESPONSES AND OBJECTIONS TO DEFENDANTS' SECOND AMENDNED NOTICE OF DEPOSITION OF DR. SCOTT A. GUELCHER

Plaintiffs hereby respond and object to Defendants' Second Amended Notice of Deposition of Dr. Scott A. Guelcher (the Notice). By making the accompanying responses and these objections to Defendants' requests for production, Plaintiffs do not waive, and hereby expressly reserve, their right to supplement, clarify, revise, or correct any or all of the responses and objections herein, and to assert additional objections or privileges to these objections and responses.

GENERAL RESPONSES AND OBJECTIONS TO THE NOTICE AND REQUESTS TO PRODUCE

Plaintiffs object to each and every document request contained in Defendants' Notice of Deposition, and further object to the quantity of document requests contained in Defendants' Notice of Deposition. Plaintiffs object to each instruction, definition and document request to the extent that it purports to impose any requirement or discovery obligation greater than or different from those under the Federal Rules of Civil Procedure and the applicable Rules and Orders of the Court. Plaintiffs generally object to each document request that is overly broad or

to the extent that it seeks documents protected from disclosure by the attorney work product doctrine. Should any such disclosure by Plaintiffs occur, it is inadvertent and shall not constitute a waiver of any applicable privilege.

SPECIFIC RESPONSES AND OBJECTIONS TO THE NOTICE AND DOCUMENT REQUESTS

Document Request No. 1: All Documents and Communications (including but not limited to (i) protocols, (ii) interim and final results, (iii) raw data, (iv) supplemental data, (v) reports of adverse events, (vi) informed consents, (vii) investigator brochures, (viii) publications and submissions, (ix) materials and minutes for any study meeting, (x) information regarding specimens and materials, and (xi) communications with co-authors, patients, health authorities, sponsors, investigators, or institutional review boards) relating to A.D. Talley, B.R. Rogers, V. Iakovlev, R.F. Dunn, and S.A. Guelcher, Oxidation and Degradation of Polypropylene Transvaginal Mesh, J. of Biomaterials Sci: Polymer Ed. (2017).

Response: Plaintiffs object to this Request on the grounds that it is overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26. Notwithstanding these objections, a copy of the final version of the requested article will be produced.

Document Request No. 2: All Documents and Communications (including but not limited to (i) protocols, (ii) interim and final results, (iii) raw data, (iv) supplemental data, (v) reports of adverse events, (vi) informed consents, (vii) investigator brochures, (viii) publications and submissions, (ix) materials and minutes for any study meeting, (x) information regarding specimens and materials, and (xi) communications with co-authors, patients, health authorities, sponsors, investigators, or institutional review boards) relating to any other study, analysis, test, clinical trial or epidemiological study concerning polypropylene or Prolene in which you

participated in any capacity, including as an investigator, safety monitor, advisor, or study committee member.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26. Notwithstanding these objections, copies of the final versions of applicable articles will be produced.

Document Request No. 3: All Documents and Communications (including but not limited to (i) protocols, (ii) interim and final results, (iii) raw data, (iv) supplemental data, (v) reports of adverse events, (vi) informed consents, (vii) investigator brochures, (viii) publications and submissions, (ix) materials and minutes for any study meeting, (x) information regarding specimens and materials, and (xi) communications with co-authors, patients, health authorities, sponsors, investigators, or institutional review boards) relating to any study, analysis, test, clinical trial or epidemiological study concerning hernia mesh, pelvic mesh, pelvic organ prolapse, or stress urinary incontinence— regardless as to the material from which the mesh was made—in which you participated in any capacity, including as an investigator, safety monitor, advisor, or study committee member.

Response: See Response to Request No. 2 above.

Document Request No. 4: All Documents and Communications relating to any publications, proposed publications, or draft submissions for publication authored by you relating to polypropylene or Prolene.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26. Notwithstanding these objections, copies of the final versions of applicable articles will be produced.

Document Request No. 5: All Documents and Communications relating to any publications, proposed publications, or draft submissions for publication authored by you relating to pelvic mesh, pelvic organ prolapse, or stress urinary incontinence.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Document Request No. 6: All Documents and Communications relating to presentations or lectures given or contributed to by you which concerned polypropylene or Prolene.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Document Request No. 7: All Documents and Communications relating to presentations or lectures given or contributed to by you which concerned pelvic mesh, pelvic organ prolapse, or stress urinary incontinence.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Document Request No. 8: All Documents, including but not limited to calculations, correspondence, data, calendar entries, notes and other materials, reflecting the compensation to be paid to You for study and testimony in this case.

Response: Plaintiffs will produce information relating to the amount of compensation that has been paid to or billed by the witness for work done in this case. Plaintiffs object to this request to the extent that it is over broad and seeks communications between the Plaintiffs' attorneys and this witness as such information is beyond that required by Rule 26(b)(4)(C).

Document Request No. 9: All Documents, including but not limited to calculations, correspondence, data, calendar entries, notes and other materials, reflecting the compensation a)

paid to You to date; and b) due to be paid to You once a bill is prepared for Your study and testimony, in connection with providing expert opinions in any pelvic mesh litigation in the last four years, in which You have been submitted a report and/or been disclosed as an expert witness for a plaintiff.

Response: Plaintiffs object to this request on the grounds that it is vague and overly broad with respect to "any pelvic mesh litigation" and, therefore, it seeks information related to products other than those at issue in this lawsuit.

Document Request No. 10: A copy of an up-to-date Curriculum Vitae.

Response: Plaintiffs refer Defendant to the expert witness's Curriculum Vitae attached to the Rule 26 report.

Document Request No. 11: If not included in Your up-to-date Curriculum Vitae, a complete list of Your publications, including but not limited to treatises, articles, journals, editorials, texts, abstracts, CLE or CME materials, PowerPoints, and seminar materials.

Response: Plaintiffs object to said request as being outside the scope of discovery required to be produced under Rule 26(a)(2)(B)(iv) of the Federal Rules of Civil Procedure. Subject to this objection, see the expert witness's CV, attached to the Rule 26 expert report.

Document Request No. 12: A complete list of all other cases in which You have testified as an expert or by deposition in the last four years.

Response: Plaintiffs refer Defendant to the expert witness's Rule 26 report.

Document Request No. 13: Copies of any deposition testimony relating to this case in Your possession.

Response: To the extent the witness has reviewed Ethicon deposition testimony, such deposition testimony is referenced in the expert's report and the attachments thereto and are possessed by

the defendant. Plaintiffs refer Defendant to the deposition testimony listed in Exhibit A to the Rule 26 expert report.

Document Request No. 14: All Documents, including but not limited to graphics, testing, recordings, spreadsheets, databases, data in any other form, work papers, and notes, whether preliminary or final, prepared by or at Your direction reflecting facts, factual assessments or assumptions, beliefs, or medical information regarding Plaintiffs relating to Your opinions in this litigation.

Response: Plaintiffs object to this Request as being beyond the scope of discovery under F.R.C.P. 26. There is no requirement under the rules that an expert's notes generated in connection with involvement in the cases, whether hand-written or in electronic format, be produced.

Document Request No. 15: All Documents, including but not limited to graphics, testing, recordings, spreadsheets, databases, data in any other form, work papers, and notes, whether preliminary or final, prepared by or at Your direction reflecting facts, factual assessments or assumptions, or beliefs relating to any other pelvic mesh cases.

Response: Plaintiffs object to this request insofar as it this Request seeks data or other information relating to the mental impressions, conclusions, opinions, and legal theories of Plaintiffs' counsel. Such information, prepared in anticipation of litigation and not disclosed or otherwise maintained in a way that is inconsistent with the purpose of the privilege, is protected by the work product doctrine and Federal Rule of Civil Procedure 26(b)(3)(B). Finally, Plaintiffs' object to this request to the extent that it is over broad and seeks communications between the Plaintiffs' attorneys and this witness as such information is beyond that required by Rule 26(b)(4)(C).

Document Request No. 16: Any and all Documents relating to or reflecting any communication involving You and any of the Plaintiff's other experts, including but not limited to other experts' disclosures, reports, or deposition testimony that You have been provided.

Response: Plaintiffs object to this request upon the grounds that said request seeks discovery beyond that required to be produced by experts under Rule 26 of the Federal Rules of Civil Procedure and seeks protected attorney-expert communications. Rule 26(b)(4)(C) specifically provides that Rules 26(b)(3)(A) and (B) protect communications between the party's attorney and any witness required to provide a report under Rule 26(a)(2)(B), regardless of the form of the communications, except to the extent that the communications (i) relate to compensation for the expert's study or testimony; (ii) identify facts or data that the party's attorney provided and that the expert considered in forming the opinions to be expressed; or (iii) identify assumptions that the party's attorney provided and that the expert relied on in forming the opinions to be expressed. Plaintiffs will not ask the expert to produce materials exempted from discovery by the foregoing rules.

Document Request No. 17: Any and all Documents, records, literature and data or information of any kind reviewed or considered by or made available to You, whether You did or did not rely on such Documents, records, literature and data or information.

Response: Plaintiffs object to this Request upon the grounds that said request seeks discovery beyond that required to be produced by experts under Rule 26 of the Federal Rules of Civil Procedure and seeks protected attorney-expert communications. Rule 26(b)(4)(C) specifically provides that Rules 26(b)(3)(A) and (B) protect communications between the party's attorney and any witness required to provide a report under Rule 26(a)(2)(B), regardless of the form of the communications, except to the extent that the communications (i) relate to compensation for

the expert's study or testimony; (ii) identify facts or data that the party's attorney provided and that the expert considered in forming the opinions to be expressed; or (iii) identify assumptions that the party's attorney provided and that the expert relied on in forming the opinions to be expressed. Plaintiffs will not ask the expert to produce materials exempted from discovery by the foregoing rules.

Plaintiffs further object to said request as seeking information outside the scope of discovery authorized under the Federal Rules of Civil Procedure, which rules do not require such production by an expert.

Plaintiffs object to any such request insofar as it would require the witness to produce any other material or to copy and produce any literature or other material the expert may have reviewed from published sources during his review and preparation of this matter, as such is outside the scope of discovery required to be produced by or relating to expert witnesses under the Federal Rules of Civil Procedure.

The witness will not be asked to produce "[a]ny and all Documents, records, literature and data or information of any kind reviewed or considered by or made available to You" as said request is so broad, over-inclusive and overbearing that it would require the witness to go back in time to the very beginning of his training and attempt to resurrect and produce all materials that he might have at any time and for any purpose reviewed. Such request is so over-burdensome as to be harassing and beyond any reasonable request authorized by the Federal Rules of Civil Procedure. Furthermore, the witness has used training and expertise in formulating opinions in this case, and it is unreasonable to require production of all background studies and experience. Defendants' request goes far beyond the discovery required to be produced by experts. The discovery request would in effect require the expert to reproduce all training and entire research over the years

relating to the subject matter of mesh, and all interactions with other professionals and scientists on the subject matter. Rule 26 is not intended to place such burdens upon the witness. Rule 26 is not intended to dampen the access of parties to experts or to silence the experts by placing such onerous burdens upon them that they shy away from becoming involved in the litigation process. To the extent the witness has reviewed Ethicon internal documents, such are referenced in the expert's report and are possessed by the defendant.

Document Request No. 18: All literature, published or unpublished, consulted by You in connection with Your opinions in this litigation, including all literature that supports or fails to support Your opinions.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs further object to this request to the extent that it is over broad and seeks communications between the Plaintiffs' attorneys and this witness as such information is beyond that required by Rule 26(b)(4)(C). Plaintiffs refer Defendants to the witness's Rule 26 Report and attachments.

Document Request No. 19: All depositions, pleadings, court opinions, or other records that were summarized for You or otherwise made available for Your review in connection with Your expected testimony in this litigation or in any pelvic mesh case.

Response: Plaintiffs object to this request on the grounds that it is vague and overly broad. In addition, this Request seeks data or other information relating to the mental impressions, conclusions, opinions, and legal theories of Plaintiffs' counsel. Such information, prepared in anticipation of litigation and not disclosed or otherwise maintained in a way that is inconsistent with the purpose of the privilege, is protected by the work product doctrine and Federal Rule of Civil Procedure 26(b)(3)(B). Finally, Plaintiffs' object to this request to the extent that it is over

broad and seeks communications between the Plaintiffs' attorneys and this witness as such information is beyond that required by Rule 26(b)(4)(C).

Document Request No. 20: All graphics or charts prepared by You or at Your direction for use at deposition and/or trial in this case.

Response: Plaintiffs object to this request on the grounds that it is vague and overly broad.

Document Request No. 21: Any Ethicon products in Your possession or Ethicon products belonging to You that You have placed in the possession of others.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Document Request No. 22: All communications from or to You relating to any professional society with respect to pelvic mesh, pelvic mesh products, pelvic organ prolapse, stress urinary incontinence, position statements, studies, editorials, and/or publications.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad.

Document Request No. 23: Copies of any letters, brochures, promotions, websites, or other Documents in which You advertise or discuss Your work or availability as an expert or consultant in litigation.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad.

Document Request No. 24: Copies of the syllabus and texts used in any classes taught by You in the past five years.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Document Request No. 25: All transcripts of prior testimony, statements or presentations given by You in any proceeding before the Food and Drug Administration, the Drug Enforcement

Agency, the United States House of Representatives, Wall Street, Financial Analysis, national Pharmaceutical Association Meetings, and on local or national television.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs further object that it seeks substantial documents and information unrelated to this lawsuit, including the products and any claims involved in this lawsuit.

Document Request No. 26: A copy of Your complete file in this litigation.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. In addition, this Request seeks data or other information relating to the mental impressions, conclusions, opinions, and legal theories of Plaintiffs' counsel. Such information, prepared in anticipation of litigation and not disclosed or otherwise maintained in a way that is inconsistent with the purpose of the privilege, is protected by the work product doctrine and Federal Rule of Civil Procedure 26(b)(3)(B). Finally, Plaintiffs' object to this request to the extent that it is over broad and seeks communications between the Plaintiffs' attorneys and this witness as such information is beyond that required by Rule 26(b)(4)(C). Plaintiffs object to this Request on the grounds that it is vague and overly broad. Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Document Request No. 27: Any communications between You and counsel for the Plaintiff, to the extent that such communications:

a. Relate to Your compensation;

b. Identify facts or data that You were provided and that You considered in forming Your opinions; or

c. Identify assumptions that Plaintiff's counsel provided You and that You relied on in forming Your opinions.

Response: Plaintiffs object to this Request on the grounds that it is vague and overly broad. In addition, this Request seeks data or other information relating to the mental impressions, conclusions, opinions, and legal theories of Plaintiffs' counsel. Such information, prepared in anticipation of litigation and not disclosed or otherwise maintained in a way that is inconsistent with the purpose of the privilege, is protected by the work product doctrine and Federal Rule of Civil Procedure 26(b)(3)(B). Finally, Plaintiffs' object to this request to the extent that it is over broad and seeks communications between the Plaintiffs' attorneys and this witness as such information is beyond that required by Rule 26(b)(4)(C). Plaintiffs also object to this request as being beyond the scope of F.R.C.P. 26.

Dated: August 15, 2017

Respectfully submitted,

s/ Edward A. Wallace
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CERTIFICATE OF SERVICE

I hereby certify that on August 15, 2017, I electronically filed the foregoing document with the Clerk of the court using CM/ECF system which will send notification of such filing to the CM/ECF participants registered to receive service in this MDL.

/s/ Edward A. Wallace

EXHIBIT D

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
AT CHARLESTON

IN RE: ETHICON, INC., PELVIC REPAIR SYSTEM PRODUCTS LIABILITY LITIGATION,
Plaintiff,
v.
THIS DOCUMENT RELATES TO CASE:
WAVE 5 CASES,
Defendant.

MASTER FILE 2:12-MD-02327
MDL 2327

JOSEPH R. GOODWIN
U.S. DISTRICT JUDGE

DEPOSITION OF SCOTT A. GUELCHER, PH.D.

AUGUST 17, 2017

- - -

Deposition of SCOTT A. GUELCHER, PH.D. held at Butler Snow, LLP, 150 3rd Avenue South, Suite 1600, Nashville, Tennessee, commencing at 8:30 a.m., on the above date, before Gina Hawkins, Tennessee Licensed Court Reporter.

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EXHIBITS

APPEARANCES

(Appearing on behalf of the Plaintiff)
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SCOTT A. GUELCHER, PH.D.
after having been first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. THOMAS:

Q Good morning, Dr. Guelcher.

A Good morning.

(Exhibit 1 was marked for identification.)

BY MR. THOMAS:

Q Dr. Guelcher, I'm going to hand you Deposition Exhibit Number 1. This is a paper from the Journal of Biomaterials Science, Polymer Edition, 2017 titled "Oxidation and degradation of polypropylene transvaginal mesh."

You're familiar with that document, aren't you?

A Yes.

Q You're one of the authors on this paper?

A Yes.

Q And in fact, you're the corresponding author?

A Yes.

Q What does it mean to be a corresponding author?

A That means that I handle all the correspondence with the editor, editorial office.

Q And do you handle any questions that people might have about the content of the study for readers?

A Well, yeah, all the authors together respond to comments from reviewers, and then I send the final response to the journal.

Q Okay. You're the point person for any issues that might arise around the article?

A That's right.

(Exhibit 2 was marked for identification.)

BY MR. THOMAS:

Q Let me show you Deposition Exhibit Number 2. And Deposition Exhibit Number 2 is titled "Supplemental Data, Supplemental Materials and Methods."

Do you recognize this document?

A Yes.

Q And is this the supplemental data that's referenced on the first page of Exhibit Number 1 down at the bottom?

A Yes, I believe so.

Q And this is the data -- Exhibit Number 2 is the data that Exhibit Number 1 refers to for the tables and figures contained in that Exhibit Number 1; is that correct?

A Yeah. There's a citation to the supplemental data in the paper.

Q Was the supplemental data made available at the same time as the original study?

A What do you mean by "made available"?

Q At the time that you published Exhibit Number 1, was Exhibit Number available?
MR. JACKSON: Objection to form.
A I didn't check that, but that's usually the standard practice in the papers published. It's typically published with the supplemental data at the time.
BY MR. THOMAS:
Q That was -- I'm sorry. I didn't mean to interrupt you.
That was your intent at the time to have the Exhibit Number 1 and Exhibit No. Number 2 available to the reader at the same time?
A Yeah, but that's the editorial office. I mean, you know, I submit the documents to the editor at the same time, and then the Journal makes it available online. So I can't control that.
That's the way it's typically done, but what I control is what I submit to the editorial office.
Q Okay. Who is Anne Talley?
A She was my former graduate student.
Q And what contribution did Anne Talley make to this Exhibit Number 1?
A I believe that she -- let's see if I addressed that in the paper. I don't remember if I did or not.
Q I don't believe that you did, but take your time.

A Yeah, so Anne, I think, did the analysis of the FTIR data to calculate the peak areas. I believe she did some of that work.
It's hard to remember exactly what else. She contributed to the writing, probably some of the methods, but it's hard to say, you know, exactly who wrote what. I would say she contributed to writing and analysis of the FTIR data.
Q And what is her area of expertise?
A Well, biomaterials. She works for FDA now, so has expertise in biomaterials.
Q And who is Bridget Rogers?
A So Bridget Rogers is an associate professor in my Department of Chemical Engineering at Vanderbilt.
Q And what contribution did Ms. Rogers make to this Exhibit Number 1?
A So her area of expertise is in films, XPS. So her contribution was, she did the XPS experiments, she analyzed the data. She largely wrote a lot of the parts of the paper on XPS. That's her area of expertise.
Q And in the report I note that Dr. Iakovlev, who's also an author, contributed the AMS explant and also cleaned the AMS explant.
Did Dr. Iakovlev make any other contribution to Exhibits 1 or 2?

A He assisted with writing the manuscript.
Q I'll note that Dr. Dunn, Russell Dunn, who's also an author, his company is noted as a sponsor of the study.
What other contribution did Russell Dunn have in Exhibits 1 and 2?
MR. JACKSON: Object to form of the last question.
A So Dr. Dunn, his company, as you said, funded the study. He performed the experiments. I should be more specific.
The FTIR and the SEM measurements were performed by Dr. Dunn and people that were being supported by the grant, I believe. He would know more of the details, but I would say that he did the FTIR and SEM experiments.
BY MR. THOMAS:
Q And what contribution did you have to Exhibit Number 1?
A So I wrote the first draft of the paper. I compiled all the data from my collaborators, my student. I prepared some of the figures, I think, and I did most of the writing.
Q Who owns the FTIR equipment that was used in the study?
A I don't -- I don't know. Russell Dunn would know the details of that. I don't know who owns that equipment.

Q Same answer for the scanning electron microscope and XPS?
A No. The SEM is a Vanderbilt resource, and so is the XPS.
Q Who was the person responsible for discussing with Vanderbilt the use of the XPS and SEM equipment for purposes of Exhibit Number 1 and 2?
A Well, that would be Dr. Dunn.
Q Did you have any involvement in that?
A Any involvement in what specifically?
Q In any negotiations or discussions with Vanderbilt about the use of the XPS and SEM for the work that's reflected in Exhibits 1 and 2.
A No, I don't believe so. That was Dr. Dunn's responsibility.
Q Did you have any control over the disbursement of funds that were provided by Russell Dunn's group for this study?
MR. JACKSON: Objection to form.
A No, I didn't.
BY MR. THOMAS:
Q Do you know whether Vanderbilt was compensated for the use of their XPS and SEM equipment?
A So the SEM is a core resource at Vanderbilt. What that means is, you pay a user fee to use it. And when

it says -- so in the acknowledgments we say that this work was supported by Polymer Chemical Technologies. Polymer Chemical Technologies paid the user fee for that SEM.

I don't remember how the XPS was handled. For the SEM it's a core resource, so the University was paid through that billing agreement.

Q What do you mean by "core resource"?

A So large pieces of equipment like SEM are -- it's not possible for individual professors to own things like this because they're so expensive to maintain, but many people want to use it. So we have large equipment like SEM that isn't a core. In this case it's the Institute for Nanoscale -- Nanoscience and Engineering. And in order to recover the costs of using the equipment, that core charges an hourly rate, and then that rate has to be paid. In this case it was paid by PCT.

So it's a facility that's owned by the University, and anybody can access it by paying the user fee. It's an hourly fee.

Q And did I understand you to say you do not know how the University was compensated for use of XPS equipment?

A I do not. That would be -- so the XPS is owned by the University. Dr. Rogers is the one who coordinates the use of the XPS.

There have been some changes to how that is

managed, and I just don't remember what was in place at that time.

Q At the time that you used the University's equipment, are you required to disclose the purpose for which you're using it?

A No. It's -- you just pay the user's fee. I mean, you would have to disclose it if it's potentially -- you know, if it's a concern about safety, but this is a pretty standard analysis. So typically that's not done.

Q Did you -- did you or any of the other authors, to your knowledge, disclose to the University that you were using their XPS and SEM machines for this specific study?

A No, there would be no reason for that.

Q Okay.

A That was handled through the -- Dr. Dunn had his -- PCT had a contractual relationship with the University, and so once that relationship is established, you're free to use the resources like you would for another --

Q Doctor, what was the purpose of Exhibit Number 1? What were you trying to set out to do?

A I believe we addressed that in the abstract. So in the study we hypothesized that polypropylene oxidizes under in-vitro conditions simulating the foreign body reaction so that the purpose was to test that hypothesis

that polypropylene would oxidize under stimulated in-vivo conditions.

Q What does this study tell us about any oxidation under in-vivo conditions?

A Well, we used a test solution. I believe that's addressed on page 3, the last paragraph in the introduction. We used an oxidized media that comprised 20 percent hydrogen peroxide and the cobalt chloride, which causes this reaction to form hydroxyl radicals, which are a form of reactive oxygen species that's present in-vivo, so we were simulating that -- those oxidative conditions.

That paper has been known for some time and cited a number of times. So that was the -- that was the approach.

Q You also it tested an AMS explant; correct?

A That's right.

Q And for what purpose did you test the AMS explant?

A I hope it's okay, what I'd like to do is read -- discuss right from the paper what I said because it's been a while. I don't -- I'm just taking a little time, if that's okay.

Q Sure. Let me ask you this question: Did you review Exhibits 1 and 2 prior to your deposition?

A I did, but I didn't have a lot of time. This

just came about pretty fast, and I published this awhile ago.

So I've reviewed these documents. I just want to be careful. So I believe that you asked me what's the purpose of the -- why did we test the explanted fiber? That's what you asked?

Q That's right.

A I can't find what I'm looking for right now, but basically we were testing the hypothesis that this oxidation could also happen in-vivo. That was the question we were asking is, can fiber also be oxidized in-vivo in the body.

Q And you obtained this AMX -- sorry.

Doctor, you obtained this AMS implant from Dr. Iakovlev?

A That's right.

Q Do you know what kind of implant it was?

A We had some discussion about this. I can tell you if it's in the -- because of patient confidentiality, we were limited in what we knew, but I can tell you what we did know.

So all we know is that it was an AMS midurethral sling. We don't know the product. We just know that it was a sling.

Q Do you know how long it was in the patient?

A We do not.

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Q Do you know the reasons the midurethral sling was removed?
A Well, it was explanted for complications other than mucosal erosion. This is what we know from the records.
Q Is that all that you know?
A Yeah. We put in the paper what we knew about the explant.
Q I'm sorry if I asked this already. My head is a little fuzzy, too.
Doctor, do you know how long the AMS implant was in the patient before it was removed?
A Yeah, I said unfortunately we don't. This is all we could get from the patient records is that it was explanted for some complication other than erosion.
Q Doctor -- sorry. You finished?
A Yes.
Q Doctor, the paper reports that Dr. Iakovlev cleaned this AMS explant; correct?
A That's right. He did that work.
Q Did he do that at his laboratory in Toronto?
A He did.
Q Did he record his methodology in removing the tissue, as he's explained in the report?
A So we explained -- he does a microscopic

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dissection where he can remove pieces of tissue using some small tweezers under a microscope, and a scalpel blade he used as well.
So he developed this technique, and I believe he's been using it for some time.
Q Have you seen a written protocol for the cleaning of the mesh that's described in Exhibits 1 and 2?
A I don't remember. I don't know that I've seen a written protocol. I mean, the level of detail that we provided in the paper is consistent with what, you know, you typically would do in a paper.
I haven't seen -- I don't know if he has a detailed protocol. I just know that he's done this for some time.
Q Do you know whether he has any notes or records of the procedure he followed to clean the AMS explant?
A I don't know the answer to that either.
Q Do you know if he has any photographs that he took during the cleaning procedure?
A Again, I suspect that he does, but I haven't seen them. He would be able to provide that information.
Q As a part of this study, was it your practice to keep laboratory notebooks of the work that you performed?
A Again, Dr. Dunn did all of that. So, again, just to make it clear, Dr. Iakovlev prepared the fibers. Dr.

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Rogers performed the XPS. Dr. Dunn did the FTIR and SEM. So they would have that experimental data. I don't have it. I didn't do the work.
Q Have you reviewed any of the experimental data, written experimental date upon which Drs. Dunn, Iakovlev, Talley and Rogers relied to generate the data that's in Exhibits 1 and 2?
A Yeah, I've reviewed the raw data with them as we were writing the paper, but I don't have it. I mean, as we were preparing the figures and writing the manuscript, I reviewed the data with them.
Q Did you have it in electronic form or hard copy?
A I don't remember. I think -- I don't remember. Usually what I do with my students is, I get the figures, and then in some cases I'll put the figures together into panels, but I don't -- we don't -- I don't necessarily keep the raw data on the studies on my computer. We store that elsewhere. I mean, I don't --
Q Where did you store the raw data that was used to generate Exhibits Number 1 and 2?
A Again, that would be Dr. Dunn's data. I didn't do it.
Q Dr. Guelcher, I'm not trying to be difficult. You testified that you reviewed the raw data generated by these folks as you did their work with them.

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A Yeah.
Q At some point you had access to that data. What did you do with the data that you reviewed with your co-authors as they generated the data that goes into Exhibits 1 and 2?
MR. JACKSON: I think that's asked and answered at this point.
A I don't remember the details. This was awhile ago. But, for example, you would run an FTIR spectrum on the FTIR machine, and those data would be stored in that computer, and then we would pull them up and look at the data.
And then the final disposition of those data, I don't know if Dr. Dunn left it on that computer or moved it off and stored it somewhere else. I don't know. It's not my data.
BY MR. THOMAS:
Q Is it fair to understand that as you sit here today, you don't have access to any of the raw data underlying Exhibits Number 1 and 2?
A What do you mean by "access"?
Q Could you get it if you wanted it?
A Yeah. I would go to Dr. Dunn and get the data.
Q And you would expect Dr. Dunn to have all of the data that underlies Exhibits Number 1 and 2?

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A That would be my -- I mean, when you do collaborative scientific research projects like this, each investigator controls his or her -- it's just the way -- the collegial way to do it. Each investigator controls his or her raw data, is responsible for storing that under some kind of long-term conditions, but we do so many runs on the instrument, it's not typical to leave all the data there. At some point somebody takes it off and stores it somewhere, but I don't typically do that.

Q I understand. I'm just trying to figure out where it might be.

A Well, Dr. Dunn would have it. I mean --

Q Would he have -- are you finished?

A Yeah.

Q Would Dr. Dunn, as far as you're concerned as the corresponding author, have control of the data from Talley, Rogers, Iakovlev and Dunn?

A I want to be really clear because I feel like there's some confusion. I may take a little bit of time to answer.

Q Sure.

A So just to make it clear, Dr. Dunn did the FTIR and the SEM, or people that worked for Dr. Dunn. I don't know the details of his arrangement. He's the PI for that part of the work, principal investigator for that part of

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the work. For the FTIR and the SEM, he would have those raw data.

Now, my student didn't do those measurements. She did the analysis. But again, everything was given back -- Dr. Dunn would have all of that. The XPS was done by Dr. Rogers, so she would have -- any additional data on the XPS Dr. Rogers would have.

And then the only thing that Dr. Iakovlev would have would be protocols and pictures, et cetera, of how he prepared the fibers. He would have that.

So if you wanted all that, you'd have to go to them to get it because it's their work. It's not my work. I worked with them to write the paper. I concede to the hypothesis and took the lead on writing the paper, but I relied on my colleagues to provide the raw data. So that's why I don't have it.

It is -- I don't want to give the impression that it's not accessible. It's just under the control of my colleagues who prepared it.

Q But to be clear, if you wanted access to the data, you could request it of them, and they would give it to you?

A I'm not comfortable doing that because it's not my work, and it's a legal proceeding. I think it would have to go through them, not through me. That's just a collegial

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way -- this was a research project. I want to make it really clear. This was not testing for litigation. This was a research project.

Q Doctor, is it fair to understand you didn't ask Dr. Dunn or any of the other co-authors for their data in order to prepare for this deposition?

A I did not because I didn't think it was appropriate.

Q All right. Let's go to Exhibit Number 1, please, and go to page 7.

By the way, in preparation for your deposition, have you read the expert reports of Dr. Thames and Dr. McLean?

A I've read them in the past several months. I didn't have time to go through them again last night, but I have read them in the past several months, I'd say.

Q Have you read their criticisms of this -- what I'll call the Talley paper?

A I have, but I don't remember exactly what those were.

Q When you read the criticisms of the Talley paper, did you go back to investigate those criticisms?

MR. JACKSON: Objection, form.

A Investigate? I don't remember. I mean, I don't know how appropriate it is to talk about other litigation

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other than this but, you know, I am working on other cases, and in the context of that I read their comments, and I made some replies in some reports. But I don't -- I just -- it would help me if you had me look at something. I'm going on my memory. It's just a little tough.

Q All I can ask you to do, Doctor.

When you say you made some replies in some reports, are those expert witness replies?

A Yes. It's not public.

Q Are these the ones you submitted in Australia?

A Yeah, I believe that I did, but I just can't remember -- I have read it, and I have thought about it, and I thought that I responded to it, but I just can't remember the details.

Oh, well, maybe one thing I can remember is that -- well, you know what? I'm going from my memory, so I just want to be -- I just can't remember details right now.

Q Sure. What's your best recollection?

A I just can't -- I can't remember right now what I wrote.

Q Okay. Are you on page 7 of your report?

A Yeah.

MR. JACKSON: When you say "report," do you mean the article?

BY MR. THOMAS:
Q I need to start over because I got the wrong page. Would you go to Exhibit 1, please, and page 10.
A Oh, okay.
Q Page 10 has a Figure 4 that has four categories of images marked A through E. What's the purpose of Figure 4?
A Would you like me to talk through the message in Figure 4? Is that what you're asking me?
Q That's right.
A So in Panel A -- and again, this is Dr. Rogers' experiments. But in Panel A, these are SEM images of the explanted fibers from the AMS mesh, and she focused on what's called an area of interest, which is that white box. And that area of interest is exposed to X-rays, and then in response you get photoelectrons that you can basically use to determine the composition of what -- of that surface in that small box.
Q What does it mean for untreated and scraped?
A That's defined in the paper. Let me give you a precise definition.
So the untreated, basically -- it wasn't scraped. We just -- Dr. Iakovlev literally -- my understanding was, he explanted the fibers from the mesh under the microscope, and he didn't do the dissection. And then the scrape -- he

did the microscopic dissection. So that would be the difference between the two groups.
Q Okay.
A So what's shown in Panel D, those are the -- those are the peaks that come off, and there's a mathematical analysis that Dr. Rogers did for those peaks to actually come up with what's shown in Panels B, C and E. Sorry, did you --
Q Just to make it clear, Panel D is the XPS testing?
A Yeah. So Panel D is the emission spectra. So in Panel D you're looking at the energy of those photoelectrons that come off the surface, and so you get these distributions. And then those raw data are analyzed to prepare the plots in Panels B, C and E.
Q What is the data that's represented in Panel B?
A So the emissions spectra tell us something about both the specific atoms that are on the surface as well as the binding states. So in Panel B, this is, we show, carbon, oxygen and nitrogen. And the point in Panel B is that the untreated fibers had nitrogen and oxygen, as you would expect, because these weren't treated, right, so there were -- again, the purpose of the scraping that Dr. Iakovlev did was to remove the protein, right, and so you would see oxygen and nitrogen on the surface, but after scraping we

don't see any nitrogen. So that would suggest there's no protein.
Q What's the atomic percentage figure on the -- I guess that's the -- on that axis?
A Well, that's the percentage of each atom that's in the spectra. So it's 80 percent carbon, 15 percent -- it's the percentage of each atom.
Q Do you expect, do all these add up to 100 percent?
MR. JACKSON: Objection, form.
A I think so, but the raw data are in the supplement.
BY MR. THOMAS:
Q I'll get to that in just a minute.
A You know, lit's the percentage of the total of everything that comes off the surface.
Q Okay. What is Panel C?
A So in Panel C we calculated the ratios of each of those atoms. So its oxygen to carbon -- so Panel C is basically calculated from Panel B. That would be oxygen to carbon, nitrogen to carbon and nitrogen to oxygen ratios.
Q Why do you do that?
A Well, the purpose here was to see, again, the nitrogen to carbon and nitrogen to oxygen ratios go way down after scraping, which basically the same point here is to

show that your scraping is removing the proteins, but there's still oxygen on the surface. So the only explanation for that would be oxidation. That's the message.
Q Just to nail this down, is there any purpose other than to show the effect of the scraping for Panels B and C?
A Well, it's not quite that black and white. I mean, I think -- the purpose of doing the scrape and the untreated is to show that, you know, before cleaning there's protein on the surface, and then after cleaning the protein is almost completely removed. There's very little nitrogen. In a lot of samples we didn't see any nitrogen, but there's still oxygen. And so the question then is, where does that oxygen come from? And what we believe is, it's coming from oxidation because there's no nitrogen on the surface, which would imply there's no protein.
So that's why we did both was to look at the change, you know, to try to be rigorous about it. That's why we did both.
Q What's the purpose of Panel E?
A So Panel E shows the bonding configurations.
Q What is a bonding configuration?
A So if we look at mechanism of degradation of polypropylene. You would expect carbonyl groups, which is

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the C over on the left. That's the carbonyl.
And then the other binding configuration is what Dr. Rogers would call carboxylate, and this is similar to the hydroperoxide degradation product.
So the point here is to show that before and after scraping we see both of those. Again -- and this is a point that, you know, Dr. Thames has made in his work about the protein. Proteins have carbonyl and carboxylate bonds. So if you have protein on the surface, you would expect to see quite a bit of bonding, which we do. But even after that protein has been removed manually, and then you don't see any nitrogen, you still see these carboxylate and carbonyl groups. That's the purpose. So it's further supporting what we saw in Panels B and C. We see the types of bonds that you would see for oxidized polypropylene even after the protein has been removed.
Q What's the significance of the carbonyl numbers standing alone?
MR. JACKSON: Objection, form.
BY MR. THOMAS:
Q Or do you have to look at them side by side in order to make --
A Oh, no -- well, how do I answer that? I'm going to try to answer your question. If you don't like it, try again. I won't be offended. I'm trying to deal with this

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in a rigorously scientific way.
Q Maybe I can help you a little bit.
MR. JACKSON: He was going to answer the question.
BY MR. THOMAS:
Q Fine. I'm just trying to make it easier on him. Go ahead.
A The reason we did both groups is because I think it's scientifically more rigorous to took at the change.
So you could just -- you could just clean the fiber and see carbonyl and carboxylate on the surface and conclude that it oxidized, but I think it's more rigorous to look at the untreated fiber as well, where you would expect to see a lot of carbonyl and a lot of carboxylate, which we do. Okay, there's protein on the surface. When I remove what I believe to be protein, those bonds come down, which I would expect, but they're still there.
So I think it's -- I prefer to really talk about it like it is in the paper, discussing it in its totality. And the reason we did those controls was to really give a good rigorous analysis and scientific perspective on what we did.
So I would say if I look at -- I know it's a long answer. But the fact that I see carbonyl on a scraped fiber would tell me -- this shows no nitrogen -- I would conclude

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that it's oxidized. I think having the untreated groups strengthens the rigor of that conclusion. That's the way I would answer your question.
So I do think it stands alone, but I like the way I present it in the paper where we do both.
Q What is the takeaway from Panel E?
A Panel E. Well, the takeaway would be that after you remove the protein, you still see carbonyl and carboxylate bonds that are consistent with the degradation products of oxidized polypropylene.
Q Let's go to page 4 of Exhibit 2. Keep that page open. You're going to need it.
A Okay. Page 4, okay.
Q Do you have that in front of you?
A Yes.
Q Do you see Table S6?
A Yes.
Q Table S6, page 4, Exhibit 2, is titled "Summary of relative amounts (percentage) of the various C 1S bonding configurations present on scraped fibers."
A That's right.
Q And that is the basis for the scraped fibers figure in Figure E on page 10 of Exhibit 1; correct?
A That's correct.
Q And S6 is where Ms. Rogers has recorded the data

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that she collected from her XPS; correct?
A Yes.
Q And if you looked at Table 6 on page 4 of Exhibit Number 2 where it says, 288 eV, that's the XPS column for carbonyl group; correct?
A Yes.
Q And of the five measurements she took, three were nondetect; correct?
A That's right.
Q And then she recorded measurements for fibers 23 and 24. At the bottom is a column for mean plus or minus SD. What does that mean?
A That's the mean plus or minus the standard deviation of those five numbers.
Q What's the purpose for including that column in this kind of table?
A You mean the row?
Q Yes, the row. I'm sorry.
A Well, we calculate the average in the standard deviation so we can compare the different groups. We can quantitatively compare the groups.
Q From an analytical perspective, what's the meaning of the mean plus or minus the standard deviation for the carbonyl group, which is .4 plus or minus .6?
A Well, that would be the standard deviation of the

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measurement. It's to measure the spread of the distribution of the data.
Q And so .4 is the mean --
A Yes.
Q -- of the values; correct?
A That's right.
Q And .6 is the standard deviation or the error rate; correct?
A I don't know if I'd call it error. It's the distribution of the samples.
So we have -- like you pointed out, there were three of them that basically were zero. We couldn't see anything. It's probably not zero, but practically speaking, it's zero. We couldn't measure it. So for two of them we measured it. We averaged them together to give -- that's what we did.
So there's a distribution of measurements. That's what's reflected by the standard deviation.
Q What does it mean when the measurement is .4 plus or minus .6? What does it mean to you as a chemist looking at this data?
A It's the spread of the distribution.
Q Does it tell anything to you about the validity of the data?
A What do you mean "the validity of the data"?

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Q The accuracy of the data as reported.
MR. JACKSON: Objection, form.
A I mean, the data that are reported. There are five measurements for the amount of carbonyl on each of the fibers. That's what reported. This is a statistical calculation.
The data are reported as they are, and some -- I'm going to say zero, even though, just to make it easier. It's not zero. It's some number that was so small we couldn't measure it, but we'll call it zero.
Three of them we didn't see the carboxylate, and two of them we did. So what that tells me is that those regions, those very small regions that were probed, after removing the protein, what we thought was the protein, it could have removed some of the oxidized polypropylene. Maybe that particular region didn't see much oxidation. We don't know, but we couldn't measure oxidation. We didn't see it. When I say we couldn't measure it, we didn't measure the presence of the carbonyl on those three regions. That's what it means.
BY MR. THOMAS:
Q Doctor, in statistical analysis, in order to have reportable data, don't you want the mean to be greater than the standard deviation?
A I mean, standard deviation, it's a measure of the

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spread of the distribution.
I explain in the paper how we did that. I mean, it's just a measure of the spread of the distribution. I'm not really sure what you're asking.
Q Can you answer the question?
A I'm trying to, but I'm not really sure what you're asking me.
Q In reporting compiled data like you have here, when you subject it to the mean versus the standard deviation, don't you want to have the mean to be greater than the standard deviation in order to have reportable data?
MR. JACKSON: Objection, form.
A But that doesn't -- no, I don't agree with what you're saying. I mean, that's a calculation of the data to enable comparisons between groups. The data stands as it is, you know. I said there's three of them we did not detect carboxylate. Two of them we did. From that distribution, we can calculate mean and the standard deviation, but we -- it doesn't detract from the data. The data are the data. They're distributed as they are.
This is just a means for modeling the data or explaining it. It doesn't detract from the data.
Q Why didn't you report, in Exhibit Number 1, the fact that the mean was less than the standard deviation?

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A I mean, I wouldn't normally report that. I mean, we did the -- we tested -- we compared the groups using different tests, and we plotted it. We showed the standard deviation. It's just a means of characterizing the distribution.
I mean, if you have a distribution centered at zero, then the means is going to be zero, and the distribution is going to be -- it's an analysis technique. It's not -- you can't control how the data distributed, how it is distributed.
Q But the meaning of the data is impacted by the mean compared to the standard deviation; correct?
A Well, the statistical testing is -- no, no. When I did the -- I'd have to go back and look at exactly what I did.
We compared distributions. This is just written here as a means for the reader to, you know, get some kind of understanding of how the data are distributed, but it doesn't impact it. The data are the data.
Q Next column on Table S6, again, which was used for Table E in Exhibit 1; correct?
A You know, Figure 4E, that's what you mean, right?
Q Correct.
A Yeah, okay.
Q It says, "287 eV, RC COOH." What does that

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represent?
A Well, it's just the nature of that carboxylate bond.
My understanding -- again, this is Dr. Rogers' work. But, you know, my understanding is, you can basically see that it's -- 287 electron volts is consistent with carboxylate type of bonding where you have a COOH -- and it doesn't tell you the actual details of the bond, but you know that you have that kind of configuration where you have carbon bonded to oxygen bonded to oxygen bonded to hydrogen. There could be several different types of bonding configurations, but it has this general structure.
So it's just too difficult to, you know, say exactly what the bonding configuration is, but it's some form of this.
Q Okay. Now, Doctor, if you look at S6 under the carboxylate bond column, they record values for fibers 5 and 8; correct?
A 5 and 8, yeah. 2.5 and 2.3, is that what you mean?
Q That's correct. If you go to page 2 of Exhibit 2 --
A Yeah.
Q Go to page 2 of Exhibit 2.
A Okay.

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Q Do you have that?
A Yeah.
Q And page 2 of Exhibit 2 shows the XPS images on which the author relied to generate the figures that are contained in Table S6; correct?
A Yes.
Q And under scraped fiber, Figure S2, there are images for Figures 5 and 8; correct?
A Yes.
Q And on S6 on page 4 for fiber 5, it shows a carboxylate bond value of 2.5. Do you see that?
A Yeah.
Q If you look at fiber 5 on page 2, there is no carboxylate peak of 2.5. Do you agree with that?
A I don't know. She didn't label it. She prepared -- Dr. Rogers prepared these figures. I don't know that I would say it's not there. Just, it's not labeled.
Q Do you see anything that resembles a carboxylate peak of 2.5 on Figure 5?
A I can't tell by looking at this resolution. I'm having a hard time seeing it.
Q You can't see it?
A Yeah, again, it's not my data. You know, Dr. Rogers did this analysis. There's an analysis that's done of these data that you have to deconvolute the peaks, and

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Dr. Rogers did that work. She would be the one to answer details about that.
It's not -- I agree that it's not labeled in the diagram.
Q And you can't see a peak that resembles 2.5 in a carboxylate area, can you?
MR. JACKSON: Objection, asked and answered.
A Yeah, I mean, I think I answered it. You know, it's very small. I'd have to look at her analysis of how she did that.
BY MR. THOMAS:
Q Okay. The same question for fiber 8 in Table S6. It shows a carboxylate peak of 2.3?
A Yes.
Q If you look at fiber 8 in Figure S2 on page 2 of Exhibit 2, there's no carboxylate peak of 2.3 appearing in that image as well?
A Same answer for number 5. I mean, again, she didn't label it. I'd have to look at her analysis to figure out what she did there.
Q Did you -- did you prepare Figure E -- Figure 4E on page 10 of Exhibit 1?
A I think so. I know I prepared Figure 4. I don't know. I can't remember if I did it or if Anne did it.
Q Would you agree with me that Figure 4E includes

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the values 2.5 for fiber 5 and 2.3 for fiber 8 in the bar chart for the carboxylates?
MR. JACKSON: Objection to form.
A Those are the numbers that are plotted in the panel.
BY MR. THOMAS:
Q Okay. And do you know the statistical impact of removing those values from what you show in 4E?
MR. JACKSON: Objection to form.
A I haven't looked at that. I relied on Dr. Rogers for this analysis, so I'd have to go back to her and discuss this with her. We calculated -- Anne and I did this together. I can't remember who did what. We were relying on the numbers that she provided in the table.
BY MR. THOMAS:
Q And the table you're referring to, Table S6?
A S6, yeah. We didn't go back and -- this is her -- this is what she did. She did the analysis of the XPS. So we were relying on her analysis, so I'd have to go back to her and discuss that with her.
Q Since you wrote this paper, you've become aware that both Dr. Thames and Dr. McLean have raised this criticism of this paper, haven't you?
MR. JACKSON: Objection to form.
A I haven't heard -- I don't remember seeing this

point. They wrote some other things about it. They -- I mean, they wrote other things. I've never seen this, though.

BY MR. THOMAS:

Q Since the publication --

A Just to clarify, this is the first time I've been aware of this viewpoint.

Q Since publication of the Talley paper, have you had discussions with -- is it Dr. Rogers?

A Yes.

Q -- with Dr. Rogers about the data in Table 6 as compared to the XPS on page 2 of Exhibit 2?

A I haven't discussed this with her for a while, probably since we wrote the paper.

Q Okay. Staying on page 4 of Exhibit 2, who prepared the tables in S4, S5 and S6?

A Dr. Rogers produced these. I mean, I may have -- I can't remember who did -- I may have made the table based on the numbers that she gave us, but she produced those numbers.

Q Okay. Who designed the tables, for lack of a better word? Who came up with the format for the tables?

A Dr. Rogers.

Q Do you see the column on S4 of 284.8 eV?

A Mm-hmm.

Q It's labeled "CH." What does CH mean?

A Well, that would be the percent of carbon in that carbon hydrogen bonding configuration. So that would be like a hydrocarbon bond. CH is what percentage of the carbon is bound to the hydrogen. The carbon bond is what percentage of your hydrogen bonds, is my understanding.

Q And you mentioned before the concept of deconvolution. What is that?

A Well, my understanding is, you have these overlapping peaks, you know, and these are distributions of energy. So they overlap in their mathematical methods that you can use to determine, you know, which peak corresponds to which type of bond or atom. That's the type of work that -- that's what Dr. Rogers does.

Q Do you consider yourself an expert in the area of deconvolution?

MR. JACKSON: Objection to form.

A Well, this is -- this is a method that -- I mean, I think I've used it before where you have it any kind of overlapping peaks and any kind of analysis. We can see this in GPC or HPLC or different chromatography. You can have these overlapping peaks. So you have to find a way to calculate which is which because the peaks -- I'm not explaining it very well.

You have to be able to separate that region of

overlap. Like I said, there are methods that have been -- that are used for this. I don't remember the details of those right now, but it's a pretty standard approach.

BY MR. THOMAS:

Q Okay.

A Again, with XPS, this is again Dr. Rogers' work. And I've published other papers with her on XPS, and she did the separation of the peaks.

Q In Tables 4, 5 and 6, the last column is 284.3 eV, and there's no description of what that area is. Do you know what that is?

A So my understanding, that particular peak is often what people refer to as adventitious carbon. I think it's in the paper. Let me see if I can find it here.

Q I'm not familiar with that term. What did you call it, adventitious?

A I think the technical term is "adventitious." Let me see if it's discuss in here, and then I can give you a more precise answer. Maybe we didn't discuss it.

Q I don't remember seeing it.

A Basically, I think the best way I can answer that is, it's some form of carbon bond that we can't attribute. It's difficult to say exactly which bonding configuration it could be. So it's a carbon bond, but we don't -- like with these other bonds we can say it's carbonyl or carboxylate,

but we can't say specifically which type of carbon bond probably because of overlapping peaks. That's my understanding.

So I would say that it's a carbon bond, but we can't provide the details, so we listed it just because -- the numbers need to add up. We listed everything that we saw. It's some form of carbon bond that we don't know the details about. I would probably say it that way.

Q Would you defer to Dr. Rogers for an answer on that?

A Yeah, she could give a more -- Dr. Rogers could give a more maybe detailed answer on that. I mean, I think she would say the same thing. We just don't -- it's a limitation of the method. You can't -- you see a peak there, but ascribing that to a specific bonding configuration is challenging, so we just report the number at the peak.

That's why we report it. Like you can see in the table, we don't list a bonding configuration because we don't know.

Q If you look at page 1 of Exhibit 2, at page 1 of Exhibit 2 right in the middle of the page it says, "The energy scales at the high-resolution spectra were calibrated to place CH2 bonding in the carbon 1s spectrum at 284.8 eV." Do you see that?

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A Yeah.
Q And we go back now to page 4 of the same exhibit, you see 284.8 eV. It says, "CH" as opposed to "CH2." Are those the same?
A I think so. I think the CH2 bonding, I think what that's referring to is a methyl group, which would be a carbon bonded to two other carbons bonded to hydrogens. So I think these are the -- I think what she's saying here is that basically the scale was calibrated so that those methyl carbons are showing up here at 284.8. I think it's consistent. That's my understanding.
Q Has anybody ever told you the column that's marked "CH" should be "CH2," and the column that's left blank should be "CH"?
A I've not heard that before. Yeah, I'm not --
Q Do you know why that wouldn't be true?
MR. JACKSON: Objection to form.
BY MR. THOMAS:
Q Does that sound implausible or impossible to you, as a person involved in this study or as a person with knowledge of this test?
MR. JACKSON: Objection to form.
A Well, I think as I answered you before, it's not consistent with my understanding of the test.
My understanding is that this is a carbon

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hydrogen bond and this is some form of carbon bonding configuration that we can't -- I mean, if we could ascribe this to a specific bonding configuration, we would have done that. That's my understanding. I'm going to look at it more. I hadn't heard that before.
Q So just to be clear, the first one you mentioned is the CH, 284.8. The second one you described was the last one, which was 284.3, which is the one not labeled in the exhibit; correct?
A Yeah, and I think we didn't label it because, again, we can't say with certainty what that bonding configuration is. It's an observation that we needed to report, but we did not assign a bonding configuration because we weren't confident in that. It's part of the total signal that came of the fiber, so we reported it.
Q Okay. So in Figures 4 and 5, if you note, that you have four nondetects in the last unlabeled column and then values of 21.9 and 23.5.
Do you have any explanation for a nondetect in 4 and a value of over 20 percent for the fiber 17?
A I'm confused about where you're talking about. That table? I don't, other than what I gave you, that it's, you know, it's a form a carbon bonding that's -- I would say that we don't believe it's carbon and oxygen bonding like the first two columns, but it's some form of carbon bonding

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that we can't say what the exact nature of the bond is.
Q If you look at Table S4, fiber 9.
A Yeah.
Q If you go across, those columns should add up to about 100; right?
MR. JACKSON: Objection to form.
A I think they should, yeah.
BY MR. THOMAS:
Q If you add them up, they add up to 104.8. Do you have any explanation for that?
A No. I'd have to look at that.
Q Would you defer to Dr. Rogers for her explanation of that, or could you answer that question?
A I would have to talk to her to find out whether, you know, that was in what she gave me or whether, when I typed the table out in the supplement. I don't know. I'd have to check. I'd have to go back and talk to her. I couldn't answer that right now.
Q Let's go back to page 2 of Exhibit 2. Page 2 of Exhibit 2 are the XPS -- do you call them spectra or images? What do you call them?
A Spectra.
Q -- spectra that Dr. Rogers took. You mentioned the concept of deconvolution.
Do you see any deconvolution in any of the images

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that are on page 2 of Exhibit 2?
A Let me be more specific about my answer. I thought this was addressed. I can't seem to find what I'm looking for.
These are -- my understanding, these are the raw data, so these are just showing the peaks. I don't think we're showing here the analysis to get those peak areas. I mean, these are just the peak -- these are the raw data, I think. She's not showing that here.
Q You mentioned that she did deconvolution of the samples she tested; correct?
A I need to find this because I'm relying on my memory. Wait a minute. Maybe it's in here. Okay. I think I found it. I'm going to be more specific in my answer. I don't want to necessarily use this term "deconvolution."
Basically, what we say in the paper is that the curve fitting to extract the contributions of different carbon bonding configurations present in the analysis area. So she did that curve fitting. I don't believe that's shown on these spectra, but she did that analysis to come up with the numbers on the table.
Q Okay.
A That's what she did.
Q And the analysis that she used to come up with the figures in the table are not available to us today; is

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that correct?
A I don't -- I don't know that -- she has that. I don't have that. Dr. Rogers would have that.
Q And it's not in Exhibit 2?
A No. That sort of work is beyond the scope of what people would typically publish.
Q So is it your best recollection that Dr. Rogers did or did not do deconvolution?
A Well, like I said, I don't think I want to use that term. I want to use the term that's in the paper. I'll just be more precise that she did her fitting and mathematical analysis to resolve these, in some cases, overlapping peaks, and she did her fitting to come up with the numbers in the table. That's what she did. Exactly how she did that, I don't know.
Q How is curve fitting different from deconvolution?
A I don't -- it's the same idea. I mean, I was using those words interchangeably. I should be really precise in that she analyzed the spectra to come up with the numbers in the table. She produced -- for the paper we showed the spectra, and we listed the results of what she called curve-fitting analysis in the paper to come up with the numbers.
The details of how she did that, we probably

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discussed this at some point, but I don't remember the details of how she did it.
Q As you sit here today, do you know any difference that you can explain to me between curve fitting and deconvolution?
A I was -- I was using those terms interchangeably. The point I was trying to make is that there are overlapping peaks in the spectra, and you have to use various mathematical methods to resolve those overlapping peaks, and that's what Dr. Rogers did. At some point I've been referring to that as "deconvolution." At other times I've been referring to it as "curve fitting." Basically what I'm saying is that there are overlapping peaks, and Dr. Rogers did the analysis to address that and come up with the numbers in the table. That's what she did.
Q And for questions about the analysis that Dr. Rogers undertook to come up with the numbers in the table, you would defer to Dr. Rogers?
A I would refer to her. I've done this in other -- I mean, I just published another paper this year doing very similar things, using XPS to look at a surface. I did the same thing with her there. She typically does the XPS. She does the XPS experiments herself. She does the data analysis. We talk about it, she explains the limitations. She explains what she did, and then we publish it, but I

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don't remember the details of exactly how she processed those data.
Q So to answer my question concisely, if you can, you defer to Dr. Rogers for the analysis that she used, whether it be curve fitting or deconvolution, to come up with the data in the tables?
MR. JACKSON: Objection to form.
A How do I say this? Yeah, she made those decisions. She made the decision about, here's the spectra. You can look at the spectra, and you can see there are overlapping peaks. And then the XPS field, there are various accepted methods. There are, again, mathematical approaches where you could address that issue of overlapping peaks and come up with -- I mean, she makes some comments like that she's using methods that are standard and published and known, but she did it, and I don't remember the details of what she did.
Q Okay. On page 2 of Exhibit 2 --
A Okay.
Q -- the document says, "A survey spectrum was collected from each fiber analyzed. Carbon, oxygen, nitrogen and silicon were present on all samples."
Why would silicon be present on any of these samples?
A Not knowing the manufacturing history -- we

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suspected it's something from the manufacturing process, but without knowing all of those details, it's hard to say for certain, but I would say probably typically, if you find something like that on the fiber, that it's going to be something related to the manufacturing of the fiber. That's our best guess.
Q Do you know the chemical composition of the Boston Scientific meshes you analyzed?
A The chemical, you mean -- the polypropylene, you mean like the formulation?
Q That's right.
A I can't remember it. I don't know. If it's a Boston Scientific product, I don't know how much detail I can give, but it's --
Q All I want to know is, does the Boston Scientific formulation of the polypropylene mesh that you analyzed contain silicon?
A Oh, I see what you're getting at. I don't know. We didn't -- that's not in the paper. I don't know.
Q And you know that the TVT formulation does not contain silicon?
MR. JACKSON: Objection to form.
A I'm trying to remember. I don't remember the formulation off the top of my head, but I can't really say.

BY MR. THOMAS:
Q Let me ask you to assume. We've done this before. Let me ask you to assume that the TVT formulation of polypropylene and its proline does not contain silicon. What could be the source of the silicon that appeared in your XPS spectra?
MR. JACKSON: Objection, asked and answered.
A Well, these are AMS fibers, so it's hard to say. I mean, I don't know. I mean, these are AMS fibers. I don't know what the formulation of AMS fiber is. We didn't look at it.
BY MR. THOMAS:
Q Okay. Fiber number 5 that had been scraped contained a small amount of chlorine. Any explanation for why chlorine might be present on fiber number 5?
A I would say it's probably similar to the silica case. We don't typically -- that would come from something in the manufacturing processing, but we don't know the source of the chlorine.
Q Okay.
A Do you want to take a break for a few minutes?
Q Sure, whenever you're ready. Let's do that.
(Recess was taken from 9:45 to 9:51.)
BY MR. THOMAS:
Q Dr. Guelcher, was there any consideration given

to conducting an FTIR analysis of the AMS explanted mesh?
A Yes, we discussed it. I can't remember if it's explained in the paper.
The problem was, as these fibers were very small, and so we were pretty constrained to -- the advantage of the XPS is, you can examine those very small regions of the fiber. I think we were really just limited on sample size to do the FTIR. We just didn't have much sample. That's what I remember.
Q Okay. Would FTIR have been your first choice?
A No, I don't think so, because, you know -- I think this is in my report. Again, with the FTIR, it's -- it has been -- you know, Clave brings it up in his paper. I've talked about it in when I wrote about Dr. Thames' study. FTIR, it's harder to be more conclusive about oxygen and nitrogen.
As I explain in the report, the EDS and the XPS are more -- they can tell you about these specific atomic concentrations. By testing fibers that have been scraped and unscraped, you know, I think XPS is a more specific technique. That's why we chose that because we can actually look at the amount of nitrogen and the amount of oxygen on the surface of the fibers.
Q Would FTIR of the scraped, explanted AMS mesh tell you the extent of your success in cleaning the mesh?

MR. JACKSON: Objection to form.
A Can I go to my report on that? I don't know if that has been entered into evidence, has it?
Can you ask that again?
MR. THOMAS: Can you read that back? I'm not sure I can remember it that well.
(Last question was read back.)
MR. JACKSON: Counsel, he said he'd like to look at a copy of his report to possibly answer that question. Is that something you could provide him?
BY MR. THOMAS:
Q I sure can, if you think that would help him. I'm trying to save time.
A I think it would. As I said, this deposition came very quickly.
Q For me, too.
A I reviewed the documents, but it helps to have things in front of me so I can, you know --
Q Doctor, I can assure you, we're both under time constraints, and I assure you I'm trying to be as efficient as I can.
A No, I understand.
(Exhibit 3 was marked for identification.)
BY MR. THOMAS:
Q I marked as Exhibit No. 3 your copy of the Wave 5

report, not the exhibits, just the text of the report.
A So the question is, would FTIR be a method for -- it's hard -- I'm going to answer to the best I can.
Q Sure.
A So with FTIR I would -- if I did -- maybe I can try answering this way.
If I did FTIR on these scraped fibers, I would probably -- I think I would expect to see carboxylate and hydroxyl bonds, as we did in the XPS. I would think I would see those in the FTIR as well.
But again, the challenge with the FTIR is that there are peaks in the proteins, and there are peaks in the oxidized polypropylene that overlap, so it's more difficult to say whether it's, you know, specifically from the protein or the oxidized polypropylene.
What the XPS again tells you is the atoms. There's so much nitrogen, so much oxygen. That's why we chose -- I think FTIR would tell you something, and of course we did FTIR in vitro. It's not that we didn't want to do it. It's just that we didn't have enough sample.
Q You relied on your visual observation of the scraped AMS explant to satisfy yourself that it had been cleaned?
A I don't think that's -- no, I wouldn't say that. I think I answered that earlier. I mean, that's why we

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did -- just going back to the paper. That's why we did -- I mean, that's why I preferred this more rigorous approach of looking at the uncleaned fiber and the scraped in considering the differences because -- Dr. Iakovlev cleaned it as effectively as he could, but by doing the XPS and looking at the atoms and the bonding, you can be much more rigorous about it.

When the nitrogen goes away, I think that's a reasonable indication that the protein was removed. That's -- so I wouldn't say we relied on visual observations. We tested both. That's sort of the basis for the conclusions in the paper.

Q So had you had more sample, would it have been your preference to do both FTIR and XPS?

A We would have liked to have done FTIR. I mean, I think in these studies, the more methods you can do, you know, reviewers like to see that.

Like I said, FTIR does give you some information, but I think you need other methods in addition to that. That's what we attempted to do here.

Q Okay.

A To clarify, in-vitro we don't have the complication of the protein. FTIR in vitro is a different situation. But for explants, as I said in my report, I think there are methods that are more specific than FTIR.

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Q Let's go to Exhibit No. 1, please, and go to page 7.

A Okay.

Q Page 7 in Figure 2 contains FTIR spectroscopy of three different meshes over a five-week period; correct?

A That's right.

Q And is this testing that people -- Dr. Dunn and people under his supervision prepared?

A Yeah. Dr. Dunn -- to my knowledge, Dr. Dunn ran these FTIR spectra.

Q Okay. And who prepared the text for Figure 2?

A You mean the caption?

Q Yeah, bottom of the page on page 7.

A I would say we wrote that together, probably. I mean, it's, you know -- I don't remember who exactly wrote it.

Q Do you see down at the bottom it says, "The carbonyl peak is indicated with the black arrow." Do you see that?

A Oh, yeah.

Q It's a mistake, isn't it?

A The black arrow, yeah. The carbonyl is the gray arrow. It's switched in the caption.

Q The hydroxyl peak, which is indicated as the gray area, is actually the black arrow?

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A Yeah. Those are switched.

Q Okay. And we decided the XPS and the SEM are owned by the University?

A Yeah. Yeah, those are University resources.

Q Who owns the FTIR equipment?

A I'm not sure about that. You'd have to ask Dr. Dunn.

Q Do you know what kind of FTIR equipment he used?

A I don't know that we go into that in much detail in the paper, but...

Q Did you review any protocols for the FTIR testing of the three meshes that are seen in Figure 2 in Exhibit 1?

A The actual testing the acquisition of the data?

Q Right.

A I mean, we talked about it. Dr. Dunn has been doing FTIR for a very long time, so he was using methods that he's used in the past.

We didn't necessarily talk about the detailed protocol that he used. We talked about the general ideas, you know, how he would do the experiment. I mean, I just -- he has a lot of expertise in that area, so I just relied on him to do it. I knew what he was doing, but details of how he put the fibers on the instrument, he did all of that.

Q So these are three different meshes; correct?

A What are three different meshes?

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Q TVT, ADV and Lynx.

A Oh, yeah. Yeah, those are the three materials that we tested.

Q And these are three materials that you placed in what I'll describe as an oxidated medium?

A That's right.

Q And then you took FTIRs before the test began?

A Yes.

Q And at week 1, week 3, week 4 and week 5; correct?

A Yeah, that's right.

Q And do you know how many -- strike that.

Are you familiar with the term "scaling" as used in FTIR?

A Scaling, that could mean -- what exactly do you mean by that?

Q Do you have any understanding what it might mean in the FTIR?

A It's kind of a broad -- kind of a broad general word. I don't -- I'm not sure what exactly you're referring to.

Q That's fine. Do you know who conducted the tests, the FTIR tests?

A Dr. Dunn, I believe.

Q You mentioned before that it might have been

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someone under his direction. Do you know anybody else under his direction that might have conducted the test?
A I don't know. It's been some time. I don't know. He would have to answer that. He may have done the FTIR spectra himself. He was pretty -- I don't know the details of how he actually did it.
Q Do you know how many scans he ran each week?
A Other than what's reported in the paper, I don't remember those kind of details. Let me see what I wrote.
We didn't report the number of scans, but again, he would have that. I just don't remember how many we did.
Q Do you know the number of scans that are generally regarded as appropriate for reporting FTIR data?
MR. JACKSON: Objection to form.
A Not off the top of my head.
BY MR. THOMAS:
Q Do you know why you run multiple scans?
A Well, I mean, I would run multiple scans to -- you know, that helps you address sort of the error in measurement. So I would run multiple scans. I just don't know how many he did here. These are details Dr. Dunn would have to address.
Q How many scans would you believe you, Dr. Guelcher, believe were appropriate to address the error in your measurement?

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MR. JACKSON: Objection to form.
A I just don't know off the top of my head. I can't remember.
BY MR. THOMAS:
Q And what errors can occur in measurement that you would need to address with multiple scans?
MR. JACKSON: Objection to form.
A I don't know. Just generally speaking, it's just good practice just in case there's some artifact in the measurement. You run things multiple times. I can't recall right now.
BY MR. THOMAS:
Q Dr. Guelcher, I want to direct your attention to Figure 2, the TVT, which is the top FTIR spectra that's listed there.
A Okay.
Q Do you see in week 1 that about halfway across the scan there's a dip in the spectra? Do you see that?
A Oh, yeah.
Q And that is a change from week 1. Do you see that?
MR. JACKSON: Objection, form.
A Yeah, but I believe you can see peaks like this with carbon dioxide. So you basically -- that's not -- we can see peaks like that in the spectra -- again, I'm going

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off my memory here -- but it's not related to any of the actual bonds that we're looking at in the spectra.
BY MR. THOMAS:
Q I understand. Do you have an explanation for what happened between week -- from the baseline, week zero, and the first week to result in that change in that peak in the middle of the week 1 spectra?
MR. JACKSON: Objection to form.
A I can't really address that without looking at the raw data. Again, this is a published paper. These are published data. I said that Dr. Dunn collected all these data. I mean, it's kind of hard to go through -- we've seen these types of things before.
BY MR. THOMAS:
Q Do you know what it is?
A I think it's carbon dioxide, but I can't remember off the top of my head.
Q Would you defer to Dr. Dunn?
A Yeah. I know I've seen this before in some of my papers where we're looking at isocyanates. Basically, sometimes these types of things will happen in the FTIR spectra. I can say I don't think this is associated with a change in the sample. I think this came up in another deposition, to be honest with you. I'm trying to remember what I said then, but I don't think it's an actual change in

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the material.
Q Is it a change in the testing environment?
MR. JACKSON: Objection to form.
A What do you mean by the environment? Maybe like the gas --
BY MR. THOMAS:
Q Something about the testing environment that altered the FTIR spectra.
A I just can't remember off the top of my head.
Q That's fine. Week 3, it looks like that peak that we just mentioned in week 1 is gone. Do you see that?
A Yeah.
Q And then in week 4 it appears again, but it's going a different direction.
A Yeah, but I don't think this is -- this is -- I think you see this in FTIR spectra, and I can't remember the details exactly of why it's there, you know. Reviewers didn't have a hard time with this. It's not relevant to the findings of the carbonyl, and it's in a totally different part of the spectra. I mean, it's -- I just don't think it's significant. It's not a significant finding. It doesn't significantly impact the finding from the FTIR data.
Q Okay. Doctor, as you look at the TVT mesh, going from weeks 1, 2, 3, 4, week 4 in the areas that you're looking at, that is, the carbonyl and hydroxyl, week 4 show

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no peaks. Do you agree with that?
A You know, they're not -- if there's a peak there, it's not as big as it is in week 5. Week 5 is where we saw the peak showing up.
Q Okay. And you'll agree that the week 4 spectra is actually smoother than the spectra from weeks 1 and 3?
MR. JACKSON: Objection to form.
A I mean, there's less noise in the --
BY MR. THOMAS:
Q Yes.
A It might appear that way.
Q Do you have any explanation for that?
A Again, these are Dr. Dunn's raw data. I can't really -- I mean, again, this is peer-reviewed. People looked at this and didn't have a problem with it. I mean, this is FTIR. You get noisy spectra sometimes.
Q Is noisy spectra the reason why you do multiple scans?
MR. JACKSON: Objection, form.
A Could be.
BY MR. THOMAS:
Q In any event, you'd defer to Dr. Dunn to answer this?
A I mean, you're going down this line of questioning that I'm really -- it's Dr. Dunn's work. It's

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kind of hard for me to speculate on these things.
Q Okay. Now, for all three of these spectra -- actually, there are 15 spectra, three different devices, five spectra for each. The spectra themselves are truncated. They're stopped at about the 1,100 level. Do you see that?
A Yeah.
Q Why is that?
A Well, again, the peaks that we were interested in were the carbonyl and hydroxyl. And just to make it easier for the reader to read the paper, in that range of the spectrum we're not necessarily expecting changes, so they're not shown here.
Now, whether Dr. Dunn went out to those wave numbers, I don't know. But what we tried to show here, these are representative spectra to give the reader of the paper an idea of the changes that we saw. That's the purpose of this figure. So over what range he ran it, I don't know. You'd have to talk to him.
Q Okay. Have you ever seen spectra for the meshes that are depicted in Figure 2 that are complete FTIR spectra?
A A can't remember. I don't know.
Q Do you remember Dr. Thames and Dr. McLean opining in their report that had you displayed the additional data

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that you would have showed that this was water confounding your FTIR spectra?
MR. JACKSON: Objection, form.
A I haven't heard that before. I don't know how they could make that opinion without seeing the spectra. I haven't seen that.
BY MR. THOMAS:
Q You haven't seen that?
A No.
Q All right. But any questions in that regard would be best directed to Dr. Dunn?
A You're just going to have to talk to Dr. Dunn because that's not -- I didn't do it. I think the question that we're going after in the papers was clear, and we explained the methods we used, and reviewers accepted it. There were no concerns about this. That's why it got published.
And those types of detailed questions about the data and how far you ran the spectra, Dr. Dunn would be the one that would have to answer that. It's not my data.
Q If you go to the Lynx mesh in Figure 2, week 4, you agree that they show no peaks either at the carbonyl or the hydroxyl peak?
A You know, again, same as before. I don't know that I'd say there's no peak, but it's much smaller.

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Q And then in week 5 there's, at least for the Lynx, there's a much larger change than either the ADV or the TVT. Do you agree with that?
A Yeah, that peak is bigger.
Q Do you have any reason or opinion about why the peaks that you found in the Lynx are so much higher and bigger than the peaks that you found in either the ADV or the TVT?
A No, that really wasn't the purpose of the paper. The purpose of the paper was not to compare meshes. The purpose of the paper was to answer the question whether mesh stabilized with antioxidants can oxidize. That was the question.
We were not trying to look for differences between the meshes. That was -- that's not a question we were really addressing.
Q But does this analysis -- strike that. But the three meshes were both subjected to the same conditions?
A Yeah.
Q And the same tests?
A Yeah.
Q So is it unreasonable to compare the finding in week 5 to the TVT to the finding in week 5 to the Lynx?
A Well, you can make whatever comparison you want, but that's not a question we're going after in this study.

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That wasn't -- you know, we weren't trying to make comparisons between different types of mesh.

We were just -- we know that they're all stabilized with antioxidants, so we were asking the question, can it happen? It happened in all three of them. That's what I can say.

Q Okay. Now, based on past litigation, I know that you're aware of the antioxidants that are contained in TVT.

A Yes.

Q Are you aware of the antioxidants that are contained in Boston Scientific?

A I'm aware of them. I don't remember exactly what they were and can't really -- even if I did, I can't really say what they are. I believe that I have seen those formulations.

Q Is it different than the TVT?

A I can't remember.

Q Do the different peaks that you see in weeks 5 for the TVT and the Lynx tell you anything about the differences in the mesh?

A Again, I think -- I thought I answered that. I'm not willing to -- based on these data, that's not discussed in the paper. That's not a question we were trying to answer. I'm not going to look at these spectra and conclude that there were significant differences because that's not a

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question we were testing. That's outside of scope of what we did.

Q Okay.

A Anybody can look at that and draw any opinion that they want, but that's not my opinion. I don't have an opinion about that.

Q That's fine. Now, the analysis that you show in Figure 2, is it fair to describe this as an accelerated oxidation study?

MR. JACKSON: Objection, form.

A I've answered this before, too, but I don't know that I would use the term "accelerated."

I mean, essentially I think the way I've answered this before is that you -- this medium simulates that privileged pocket between the macrophage and the material surface, and so it's essentially like you're exposing the entire material to that privileged environment.

So I don't know that I'd call it accelerated. I think what this method does is, it produces hydroxyl radicals, which are reactive oxygen, and so it simulates what can happen in the body. That's what I think has been published about this medium, and I've published other papers on it. We talked about it before.

Q That was the prior paper that you presented, different organizations, correct?

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A It what?

Q I haven't talked to you about the Talley paper before. I've never asked you questions about that before.

A No, but some other Ethicon attorneys have.

Q Not in the context of Talley?

A No, but it's the same answer. I've been asked about this medium before. I mean, the medium simulates the microenvironment between the macrophage and the adherent -- well, I didn't answer that very well. It simulates the environment between the macrophage and polypropylene surface.

MR. THOMAS: Let me show you Exhibit No. 4.

(Exhibit 4 was marked for identification.)

BY MR. THOMAS:

Q This is the paper that we've talked about before; correct?

A Yeah. This isn't a paper. This is a published conference proceedings.

Q Just so we're clear, you don't rely upon this test and this data in the opinions that you're giving in this case; correct?

MR. JACKSON: Objection to form.

A I don't remember if I cited it in the report, but this is a conference proceedings that was published before the paper. So the paper basically, I think, includes all of

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these data. I haven't looked at it recently, but I believe, just looking at it right now, the paper includes the data in this conference proceedings.

So I don't want to say I'm not relying on it, but it's, you know, it's a paper -- most of what's in this abstract is incorporated in the paper.

MR. JACKSON: I just want to state for the record this was Exhibit 3 at his last deposition.

MR. THOMAS: I understand that. The reason why I asked is because I understood --

THE WITNESS: I'm not sure what you're getting at, I guess.

MR. THOMAS: I'm not either. I don't want to plow old ground.

THE WITNESS: I understand that. I'm not sure what you're asking.

MR. THOMAS: I didn't take the last deposition. I think Mr. Hutchinson did.

BY MR. THOMAS:

Q Let me back up because I think I may be talking about different things.

A Okay.

Q There is yet other papers about other work that you did that you presented I think in Europe, and that was the subject of a motion in the Boston Scientific litigation,

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and after that time you stopped relying upon that data in your opinions in the case.

MR. JACKSON: I'm going to object to form of the last question. I think we're getting pretty far afield here. We're talking about a different litigation.

MR. THOMAS: All I'm trying to do, Tim, is to limit his opinions because -- I don't mean to make it a speech, but I'm trying to shortcut this.

BY MR. THOMAS:

Q You did some earlier work that you presented, and we went through the background data. We went through all the stuff.

A I think I know where you're going.

Q At some point you stopped relying on that data in your opinions in the case. All I want to do is establish that you haven't changed your mind and are now relying on testing and results that you reported before and presented before that you previously withdrew.

A I know this is your question on the table. It would really help me out to just deal with this head-on if I could talk with counsel for a few minutes.

Q Sure.

MR. JACKSON: Could we take a two-minute break?

THE WITNESS: I'm not trying to give you a hard time.

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MR. THOMAS: I'm not worried about that because I want to make this quick and easy too. Let's go off the record.

(Recess was taken from 10:22 to 10:32.)

BY MR. THOMAS:

Q Doctor, are the FTIR spectra that are on Figure 2 of Exhibit No. 1 the result of tests that we've previously discussed in deposition, or have you done a second set of tests?

A No, we haven't done a second set of tests.

Q Okay. Just so we're clear -- and I think we talked about this before because I think I asked you questions about it -- some time ago you conducted a five-week oxidation study that you presented at least at one conference and disclosed those opinions in an expert report; correct?

A That's right.

Q After the disclosure of those expert opinions, for whatever reason you stopped relying upon the test results in that report for your opinions.

A Yes. Yeah, I didn't rely on the test data.

Q Is it fair to understand that now that the data has been published that you are now relying on that data for your opinions in this case?

A I don't -- well, I don't remember exactly what

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was in those test data. I don't think we had a lot of the analysis that we presented in this paper.

Q Exactly right.

A So the raw data we looked at and did some additional analysis and thinking and submitted paper, a publication which was peer-reviewed and published. So we did not repeat the experiment, but we did more work on the analysis to basically present the paper in a form that could be published.

Q Right. To be fair, I think the XPS data is new?

A I believe it is, but I can't remember exactly what was in that report.

Q And the AMS explant analysis is new?

A I don't think that was in any test data -- I can't remember. To the best of my knowledge, I believe it's new, but I just can't remember what Dr. Dunn disclosed in his test data.

Q Okay. Dr. Guelcher, if you look back at Figure 2 on page 7, the carbonyl peaks that are there that are mislabeled with the gray arrow, do you know if those carbonyl peaks appear at the same place for each mesh?

A I'd have to go back and look at the raw data. There are multiple -- there can be multiple carbonyl peaks. I can't remember if they're different for each.

Again, that's not what -- we weren't answering

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that question in this paper, so I really don't think we looked at it. We were just looking at that -- well, we explained what we did. 1,500 to 1,750 is where you'll see those carbonyl peaks, and we weren't looking for differences between products or materials.

Q You agree that an FTIR is designed to generate a fingerprint for a particular substance?

A I don't know that I'd say it that way. Basically the FTIR gives you information about bonds based on vibration frequencies. But carbonyls -- I mean, I think this has come up in previous depositions -- there can be multiple peaks. This is all even in some of the Ethicon documents that I cite in my report. There can be multiple carbonyl peaks, and we just didn't look for differences between materials.

Q Would you expect polypropylene in different meshes that are exposed to the exactly the same conditions as you did in your study in Exhibit 1 to display the same carbonyl peak if in fact it was oxidized polypropylene?

A I'm going to have to go to my report for that one. I know that it's in here.

I think the best I can answer is like I did. There are multiple species. There are a number of Ethicon documents reporting different carbonyl peaks that could be resulting from different species. I wouldn't necessarily

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expect different materials from different manufacturers to have different peaks. I can't rule it out. I don't know that -- it's just, there's just multiple species, and it can be difficult to assign some of them to specific bonds, you know, real precisely.

This goes back to what I was saying about the difference between XPS and FTIR. I mean, I can say broadly that if the polypropylene is oxidizing based on reaction mechanism, I would expect to see carbonyl peaks, and that's what we tested in this paper, but we just weren't looking at that level of detail for differences between groups.

Q I want to talk now about the AMS explant that Dr. Iakovlev supplied. Do you know how he scraped it?

A Again, you'd have to talk to him about those details. I think you know Dr. Iakovlev's papers, but he prefers to work with dry mesh to get around this protein cross-linking issue that Dr. Thames referred to.

So Dr. Iakovlev has been doing it for some time. I've seen his microscope. I've seen his lab. Exactly how he does that procedure, I don't have the details.

Q It's fair to understand, from a review of Exhibit 1 or Exhibit 2, there's no way for another researcher to replicate this cleaning technique. Do you agree with that?

A I don't agree with that. I think he gave enough

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detail in the paper that obviously satisfied the reviewers as to how those materials can be cleaned. He manually dissected it under a microscope with tweezers and a scalpel blade. I think that can be replicated. I don't see a problem with that.

Q With all due respect, the only place I saw for a description of his methodology is on page 1 of Exhibit 2.

A I was looking at page 5 in the paper where he says -- the X-ray photoelectron spectroscopy paragraph, he says, "Scraped fibers in which the outer layer was mechanically removed using tweezers and a scalpel blade under dissection microscope."

Q Is that the extent of methodology that you're aware of?

MR. JACKSON: Objection to form.

A Yeah. I mean, I think it sounds pretty straightforward. He's been doing it for some time. The reviewers were fine with it. I mean, it's a mechanical dissection of tissue. People do that.

Again, if you wanted all the details, if he has a protocol and all that, he would have to address that. I mean, I think for a paper, this is a reasonable description of the methodology. I'm looking on Exhibit 2 to see what's written there.

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BY MR. THOMAS:

Q The first page.

A Yeah, so we don't describe -- referring back, this is just supplemental material. So I think the primary description of what he did is in the paper.

Q Okay. Can you tell how much force he used in scraping, from the paper?

A Well, I mean, I think the point of what he was trying to do was to be as gentle as possible without -- basically the purpose is -- you know, when you say the outer layers mechanically removed, that means that when you look at these under a microscope, you'll see these layers of tissue, and you can gently remove them with a pair of tweezers. That's what I understand that he did.

Q How thick is the layer of protein that's absorbed onto the mesh material?

MR. JACKSON: Objection to form.

A Absorbed, or do you mean adherent protein? I'm not sure what you mean.

BY MR. THOMAS:

Q I'll use your term, "adherent protein." How thick was that layer?

A I'm not sure.

Q On the order of a few microns?

A I don't know.

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Q Do you know how thick the blade is on a scalpel that he used, how it compares to the thickness of the proteins on the mesh?

A I don't. Again, these types of detailed questions -- I don't know those types of details. Dr. Iakovlev did this, and I can't speculate on those types of things.

Q Was there any consideration to testing the scraped mesh explant for other oxygen-containing molecules such as esters or cholesterols?

A Well, I mean, again, we have to rely on what the XPS can tell us, and the XPS can tell us information about atoms that are there and the bonding. So esters are going to have carbonyl groups in them. It tells us about what molecules are there and the way that they're bound to each other.

Q So you're looking at the data on the table that's on page 4, Exhibit No. 2?

A I was referring back.

Q Is there anything about the data on page 4 of Exhibit No. 2 that tells you that the oxygen that was found on the mesh explant was not an ester or a cholesterol?

A I mean, it is an ester. I mean, I'm not sure what you mean by ester. I mean, it's an ester bond. I mean, it's -- well, it's not ester bond. It's a COO.

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That carbonyl is present in an ester. If you look at the degradation products -- I have to go back to this. So I see what you're saying. I mean, an ester bond would also have that carbonyl. It could also be, I think, carboxylate. So it's not -- the XPS is just telling you about those specific types of bonds. So, like in protein, you could have esters, right. So it's -- I'm not being very clear.

The XPS tells you again about the type of bond. You could have a carbonyl and an ester bond. It's also present in the degradation of product from the polypropylene.

Q Right. And cholesterol may also appear in the carbonyl group?

A Maybe. I'd have to look at the structure.

Q Why didn't you do a controlled experiment on a pristine AMS mesh?

A What do you mean by "controlled experiment"?

Q Do the same testing XPS on a pristine AMS mesh.

A I don't remember.

Q Did you have that discussion?

A I don't remember.

Q Did you have pristine AMS mesh available to you?

A I don't remember that either. Dr. Dunn had all those materials. So I can't remember that one either.

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Q What did you do to rule out contamination of the explant?

MR. JACKSON: Object to form.

A Contamination?

BY MR. THOMAS:

Q Yes. Something from the environment that didn't come from the mesh when it was implanted in the patient.

A I mean, we use standard methodology for XPS analysis, according to Dr. Rogers' papers. We removed the protein mechanically the best we could. We tested, compared the untreated to the treated -- and I'm sorry -- untreated to the scraped. That's what we can do. I mean, we have no evidence to believe there was significant contamination that would alter the results.

Q But you didn't take any steps to confirm that the AMS explant had not been contaminated?

MR. JACKSON: Objection to form.

A I'm not really sure. Again, Dr. Rogers did that work. It's difficult for me to -- I mean, we used existing methods that we've used before to clean the mesh and to analyze it. Dr. Rogers has published on XPS. I've published with her on XPS. We use standard methods and protocols for doing that work. There's no evidence to suggest there was contamination. So that's kind of the way the science is done.

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BY MR. THOMAS:

Q Doctor, would you turn to page 6 of Exhibit 1. Page 6 of Exhibit 1 includes a paragraph called "Surface degradation caused by SEM."

A Yes.

Q And who conducted this work?

A Dr. Dunn.

Q Do you know what kind of scanning electron microscope was used?

A That's hard to answer. We've replaced that instrument at Vanderbilt. I can't remember where we were on that when this work was done. Maybe -- well, let me see. It might say in the -- we have several different SEMs. It's Hitachi. We have a newer one now, I think.

Q What is it about the Hitachi SEM that allows measurement of peak depth?

A Peak depth?

MR. JACKSON: Objection to form.

A Well, we used --

BY MR. THOMAS:

Q You have a number of measurements in this paragraph going from 1 micron to 10 microns. How are you able to measure that?

A Well, I mean, as you can see, these are -- we're saying greater than -- you know, these are not -- we didn't

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do statistical analysis on these measurements.

So the flaking, we have a scale bar on the SEM, and you can see that those flakes and peeling features are greater than 10 microns based on that scale bar. The depth of the pits is a little bit more difficult. You could estimate that to be in the range of a micron. We were just trying to give some idea of the length scale of the features.

Q Is it fair to say the numbers there are estimates?

A I would say they're semiquantitative numbers based on the images that are shown in the paper.

Q If you go to page 9, there are scanning electron microscopy images. Are there more images than what are contained in the report?

A So, I mean, it's the same for Figure 2. These are representative images to give the reader some perspective on what we saw. We -- I think we list them in the report. I'm sorry. I keep saying -- this is a paper.

Q I understand.

A A published paper. I'm getting confused. So in this paper we are -- so I basically -- we used low, medium, high-magnification images. I think in the methods we discussed how many images we took of each one, 5 to 15 images of each specimen. It just depended, it seems, on the

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specimen. So we have multiple images. These are representative ones to give some perspective on what we saw.
Q And you would expect Dr. Dunn to have those images?
A Yeah.
Q Was he the one that provided the measurements and data that went into the paragraph I've just described on page 6?
A That was probably me. I can't remember exactly. I probably did that.
Q How did you do that? By looking at the scale bars?
A Yeah. So you can look at the scale bar, and you can kind of draw a line on the feature. You can see that it's -- the purpose of like the greater than is to show that it is semiquantitative. We're giving some idea of a length scale. We didn't do specific measurements on those features. We just were trying to provide some perspective on the length scale.
Q So other than the scale within the SEM itself, there was no effort to have a more precise measurement?
MR. JACKSON: Objection to form.
A You know, it's just difficult to measure that. The depth of a pit, you know, you could do profilometry, but it's not a flat surface. It's difficult to measure that

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depth precisely. So we were doing the best we could from these images.
BY MR. THOMAS:
Q And using the scale that's in there?
A Yeah.
Q Do you recognize in the paper that the flaking and pitting that you observed and report on page 9 in the SEMs is different from the transverse tracking that's been reported in other papers; correct?
MR. JACKSON: Counsel, when you say "report," we're talking about the published paper, right?
BY MR. THOMAS:
Q Dr. Guelcher, it's fair to understand that you reference in your paper the fact that the flaking and the pitting that you report and show in Figure 3 on page 9 of this paper is different from the transverse cracking that has been reported by others?
A I think we addressed that in the discussion. So there's some -- yeah, so the last paragraph of discussion, you know, the point that we're making there is, this corrosion and stress cracking can happen when you have a combination of mechanical forces and chemical degradation, and in this experiment we only had chemical degradation.
So we would not expect to see necessarily those transit cracks. It's the combination of forces, say

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contractile forces from cells that infiltrate the mesh. So it's a combination of those forces and the chemical environment, chemical degradation that causes those cracks, and we believe that's why we didn't see it. That's what this discussion is saying.
Q Was there anything about this experiment that prevented you from including some application mechanical force to try to replicate the transverse cracks?
A Well, it can be done. It's just this was a first step. I mean, the first question we wanted to answer really is, can something oxidize? That was a question in this paper.
I mean, to answer the cracking question, you would have to include some kind of stretching protocol, and that takes considerably more resources, time, effort and work. And we thought it made sense to start with the oxidation question since, you know, the degradation is a consequence of the oxidation. So that's why we started with that question, and that's why we didn't do mechanical forces in this study.
Q Do you have plans to do any further study which would include the application of forces to try to replicate the transverse cracking?
A I mean, these are research studies that are funded by external sponsors, so I can't really talk about

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what we're doing.
Q You can't answer the question?
A No, I can't. It's research. I mean, I can't really talk about any research that we're doing. For this Wave 5 report on the line and these documents we've been talking about -- I just can't really talk about what we're doing right now. We're not relying on it.
Q Do you have ongoing studies into the oxidation of polypropylene?
A I just can't talk about it.
Q Can you answer yes or no?
A No, I can't answer yes or no. I can't really talk about what we're doing. It's an externally funded research project. It's confidential.
Q Can you tell me who's funding the research project?
A I mean, I never said there was a research project. I'm saying that, you know, our plans and ideas, these are all -- it's research. It's confidential.
Q Okay. We may have to come back to that. How do you measure embrittlement?
MR. JACKSON: Objection, form.
A I think it's in my report, but I'll -- embrittlement you could -- you could measure by mechanical testing, dynamic mechanical testing. It's a mechanical-type

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test.
BY MR. THOMAS:
Q Have you done any embrittlement testing of any of the meshes that you've tested in Exhibit No. 1?
A We have not. Again, it's a very technically challenging test to do, so we decided to start with things we could do using known and established methods.
Embrittlement requires a certain kind of -- it would be more difficult to do, and we have to -- we haven't done it.
MR. THOMAS: Let me take a break. Give me a few minutes. I may be close to wrapping up.
MR. JACKSON: All right.
(Recess was taken from 11:00 to 11:05.)
(Exhibit 5 was marked for identification.)
BY MR. THOMAS:
Q I'm going to hand you now what's been marked as Deposition Exhibit Number 5, the Second Amended Notice of Deposition. This requested that you bring with you to the deposition a number of things. I've received the filing by your counsel about objections. I've also received some billing information, a copy of the 2017 published article, which is Exhibit 1, supplemental data which is Exhibit Number 2.
There is a deposition request that you also

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produce all of the underlying data for the Exhibit Number 1 and Exhibit No. 2, and I believe we've covered that today in your deposition, that is, to the extent that that data is available, it's in the custody or control of the people who conducted the work and not in your current possession. Is that fair?
A That's right.
Q And you did not ask them to give that information to you for purposes of this deposition; correct?
A I did not because that's just not how things are done. I think if you want somebody's data, you have to ask them directly.
Q Have you had any -- as corresponding author, have you had any inquiries about the work that went into the Talley study?
A I've had requests for the paper, and I've sent that to people, but I haven't had any detailed questions about it.
Q Other than producing the paper, have you discussed with anybody else your methodology or the results that you've reached?
A Not that I can remember.
Q Where does Ms. Talley live now, Dr. Talley?
A She lives in Maryland. She works for FDA.
Q When did she take her job with FDA?

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A Maybe a year ago. No, six months. Within a year.
Q What does she do for FDA?
A She is a reviewer of medical device applications.
Q Where does she work in Maryland?
A She works at FDA.
Q I understand that, but Maryland is a big state. I don't mean to be flip, but I'm just trying to find out which city.
A I don't know. I don't know where exactly she lives.
Q Is it closer to Washington D.C. or closer to Baltimore? Do you have any idea?
A Probably D.C.
Q And Dr. Rogers still work at Vanderbilt?
A Yes.
Q Dr. Dunn still at Vanderbilt?
A Yes.
Q Were you the person who was responsible for organizing the study?
MR. JACKSON: Objection, form.
A I would say that Dr. Dunn and I did that together. We thought about what question we want to ask, how we could design the study, then we maybe talked to Dr. Iakovlev about explants.

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So probably mostly it was probably Dr. Dunn and me planning the study.
BY MR. THOMAS:
Q On page 13 of Exhibit No. 1 under the disclosure statement and funding it says, "Russell F. Dunn is the owner of Polymer Chemical Technologies, which sponsored the work."
A Yes.
Q Are there other employees of Polymer Chemical Technologies, to your knowledge?
A I don't know at the moment. You would have to ask Dr. Dunn about that. I don't know if he has any employees right now.
Q There's been a time when that was just him?
A I mean, his business has changed over the years. Sometimes he's had employees, sometimes not. So I don't know right now. When this work was done, I don't know.
Q The work was supported by Polymer and Chemical Technologies, LLC, Grant Number VU1349. Did you prepare a grant request to Polymer and Chemical Technologies for this work?
A No.
Q What is -- is VU Vanderbilt University?
A Yes.
Q So how does Vanderbilt University 1349 obtain a grant from Polymer and Chemical Technologies?

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A I mean, any company can enter into an agreement called a sponsored research agreement. I've done this before with other companies. Any company can enter into an agreement with the University to sponsor research. It's a standard thing.
Q Is it your suggestion that Vanderbilt is a sponsor of this research?
A No.
Q Okay.
A It's a sponsored research agreement so an external sponsor -- could be a foundation, could be federal government, could be a company -- enters into a contractual relationship with Vanderbilt University where they agree to sponsor research at Vanderbilt. So they pay for the research, but the research is done at Vanderbilt. So there's a contract that regulates that.
Q So there's a contract for this study between Polymer Chemical Technologies and Vanderbilt University?
A I don't know if it's for the study. Again, you'd have to ask Russell about the details of how his company -- his relationship between his company and Vanderbilt is something I can't really address.
What I can tell you is that when this says Grant Number VU1349, that means that there's some sponsored research agreement between Polymer Chemical Technologies and

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Vanderbilt. The scope of that agreement, I don't know the details. That's all I can say from that sentence.
Q How much was the grant?
A I don't know.
Q Was there any other financial support to the work in Exhibits Number 1 and 2 beyond what was supplied by Polymer and Chemical Technologies, LLC?
A No.
Q Do you know whether Polymer and Chemical Technologies, LLC obtained money from any other source to fund this research?
A I don't -- again, I don't know the details of how the company contracted with Vanderbilt. I don't know those details. I can just -- from the way that's written, I can infer that there's a contract.
Q If you had any conversations with any lawyers about obtaining money to be supplied to Polymer and Chemical Technologies, LLC that would be used as a grant to fund the work in Exhibits Number 1 and 2?
MR. JACKSON: This is clearly privileged information you're asking him about.
MR. THOMAS: Oh, I don't think so.
MR. JACKSON: No?
A Again, I have no relationship with Polymer Chemical Technologies. This is Russell Dunn's company.

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He's the owner, as it says here. I don't -- I don't know -- I mean, I can't answer these questions. You're asking questions about how Polymer Chemical Technologies, who I have no relationship with, is doing business. I can't answer that.
BY MR. THOMAS:
Q I asked you whether you've been party to any conversations where it was determined that lawyers in this litigation would fund Polymer Chemical Technologies, LLC to supply the grant for the work that's done in Exhibits 1 and 2.
MR. JACKSON: I think to the extent you're asking about conversations between attorneys and the witness, that's privileged information.
MR. THOMAS: Are you directing him not to answer?
MR. JACKSON: I think he's already answered the question.
MR. THOMAS: Are you directing him not to answer?
MR. JACKSON: No, I'm not, because I think he's already answered the question.
BY MR. THOMAS:
Q The question is, have you been party to any conversations with lawyers where it's been discussed lawyers funding Polymer Chemical Technologies, LLC grant for the work that's done in Exhibits Number 1 and 2?

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A I mean, I can't really discuss all the conversations we have with counsel. I mean, I --
Q He hasn't instructed you not to answer. He's permitted you to answer the question.
MR. JACKSON: I'm instructing him not to answer to the extent it calls for any communications between himself and attorneys.
MR. THOMAS: That's fine. We'll fight that one.
A Let me think about this for a second, all right. I'm trying not to --
MR. JACKSON: I think he's already given you an answer to the question.
MR. THOMAS: I'm not going to argue with you.
A Let's just -- can we just go with what's written here? Can we do that?
BY MR. THOMAS:
Q I can read it as well as you can. I'm just trying to figure out what else is involved that's not here.
A Well, what did we disclose? Russell and I -- Dr. Dunn and I have disclosed these matters to the University, and we have -- we have an annual disclosure, and all of this has been disclosed.
In the paper we disclose several things. We say that Russell Dunn is the owner of Polymer Chemical Technologies. Polymer Chemical Technologies sponsored the

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work.

I mean, that means that that company, through this grant, VU1349, gave money to Vanderbilt, and this work was done within that context.

I don't know the details of that contract. I don't know if it funded other work. All I know is, there's a contract between PCT and the University, and this work was done within the context of that contract. Dr. Iakovlev and I disclosed the fact that we provided opinions in these cases. So this is what we disclosed.

To go into like conversations with attorneys about paying for experiments, I can't talk about that. That's -- this is, you know, privileged information with attorneys.

Q Okay.

A We did not say that they funded the study. This study was funded by the company. But I can't go any further than that. I can't --

MR. THOMAS: I keep forgetting I've got more time than I thought I did. I'm on eastern time. Doctor, I'm going to quit. Thank you very much for your time.

THE WITNESS: Thank you.

MR. THOMAS: Have a safe trip to Australia.

MR. JACKSON: I have no questions.

(Deposition concluded at 11:17.)

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CERTIFICATE

I, Gina Hawkins, Licensed Court Reporter for the State of Tennessee, do certify that the above deposition was reported by me and that the foregoing transcript is a true and accurate record to the best of my knowledge, skills, and ability.

I further certify that I am not an employee of counsel or any of the parties, nor a relative or employee of any attorney or counsel connected with the action, nor financially interested in the action.

I further certify that I am duly licensed by the Tennessee Board of Court Reporting as a Licensed Court Reporter as evidenced by the LCR number following my name below.

Subscribed and sworn to before me when taken this 17th day of August, 2017.

____

GINA HAWKINS, LCR #780
Expiration Date: 6/30/2019

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ACKNOWLEDGMENT OF DEPONENT

I, SCOTT GUELCHER, Ph.D., do hereby certify that I have read the foregoing pages and that the same is a correct transcription of the answers given by me to the questions therein propounded, except for the corrections or changes in form or substance, if any, noted in the attached Errata Sheet.

____

SCOTT GUELCHER, Ph.D. Date

Subscribed and sworn to before me this
___ day of ___________, 20__.
My commission expires:_______

____

Notary Public

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____

ERRATA

____

PAGE	LINE	CHANGE/REASON

LAWYER'S NOTES

PAGE LINE

EXHIBIT E

Robyn Davis

From: David Thomas
Sent: Wednesday, August 30, 2017 11:22 AM
To: Timothy Jackson
Cc: Aaron Arthur; Robyn Davis; Edward Wallace; David Thomas
Subject: RE: Guelcher

Tim—as you know, notwithstanding the specific request in the Notice of Deposition and the email below in advance of the deposition for the data underlying the Talley paper, Dr. Guelcher did not even attempt to produce that information at the deposition. Ethicon will file a motion to compel production of the information unless you agree by close of business Thursday, August 31 to produce the requested information and make Dr. Guelcher available for further deposition on the requested information.

David

From: Timothy Jackson [mailto:TEJ@wexlerwallace.com]
Sent: Wednesday, August 16, 2017 2:32 PM
To: David Thomas <DThomas@tcspllc.com>
Cc: Aaron Arthur <AArthur@tcspllc.com>; Robyn Davis <RDavis@tcspllc.com>; Edward Wallace <EAW@wexlerwallace.com>
Subject: RE: Guelcher

David:

The supplemental data for the 2017 study is attached.

Tim

From: David Thomas [mailto:DThomas@tcspllc.com]
Sent: Wednesday, August 16, 2017 8:22 AM
To: Timothy Jackson
Cc: Aaron Arthur; Robyn Davis; Edward Wallace; David Thomas
Subject: RE: Guelcher

I am sure it was just oversight, but the supplemental data referenced in the study is not attached to the 2017 study. We also asked for all of the raw data (FTIR, XPS, etc.) underlying the 2017 study. If you are refusing to produce, we will deal with at a later time. But if you are willing to produce, please make sure that is included in the production. Thank you.

David

From: Timothy Jackson [mailto:TEJ@wexlerwallace.com]
Sent: Tuesday, August 15, 2017 6:31 PM
To: David Thomas <DThomas@tcspllc.com>
Cc: Aaron Arthur <AArthur@tcspllc.com>; Robyn Davis <RDavis@tcspllc.com>; Edward Wallace <EAW@wexlerwallace.com>
Subject: RE: Guelcher

David:

We sent you a final copy of Dr. Guelcher's 2017 article earlier today. Without waiving any of our objections, the other materials have already been produced at prior depositions. We will get you billing information.

Thanks,
Tim

From: Edward Wallace
Sent: Tuesday, August 15, 2017 4:00 PM
To: David Thomas
Cc: Aaron Arthur; Robyn Davis; Timothy Jackson
Subject: RE: Guelcher

Just so we don't run into issues – we are giving you docs tomorrow but some seem duplicative. Keep Tim on this chain and pls raise issues you have, if any, w production so we only do this once. I know you like that idea too – so thanks.

From: David Thomas [mailto:DThomas@tcspllc.com]
Sent: Sunday, August 13, 2017 8:50 PM
To: Edward Wallace <EAW@wexlerwallace.com>
Cc: Aaron Arthur <AArthur@tcspllc.com>; Robyn Davis <RDavis@tcspllc.com>
Subject: RE: Guelcher

I will make the 17th work provided you do not complain of inadequate time to produce the documents we request for the deposition. They should be readily accessible. We will schedule the deposition for 9 a.m. at Butler Snow in Nashville. Notice will be filed tomorrow. I have some medical tests tomorrow so will be hard to catch. Email best. Please confirm. David

---

From: David Thomas
Sent: Sunday, August 13, 2017 9:46 PM
To: Edward Wallace <EAW@wexlerwallace.com>
Cc: Aaron Arthur <AArthur@tcspllc.com>; Robyn Davis <RDavis@tcspllc.com>
Subject: RE: Guelcher

From: Edward Wallace [mailto:EAW@wexlerwallace.com]
Sent: Sunday, August 13, 2017 9:18 PM
To: David Thomas <DThomas@tcspllc.com>
Cc: Aaron Arthur <AArthur@tcspllc.com>
Subject: Re: Guelcher

The problem is that this ruling comes around his family vacation, commitments he cannot move and a work trip overseas. I have finally nailed down the morning of August 17, which is this Thursday. He says that is literally the only date that he can do given the time constraints and he is delaying a trip just to make himself available. I assume you don't have much at all in the way of questions and he needs to be done by noon that day. Otherwise, it looks like he would have to be deposed by video from overseas if that and would likely then be available in the US after Labor Day. Let me know tonight or first thing in the a.m. as possible.

On Aug 13, 2017, at 10:03 AM, David Thomas <DThomas@tcspllc.com> wrote:

> I am available the entire week of August 21. Out this week in meetings and the week of Labor Day in depositions.

On Aug 13, 2017, at 10:52 AM, Edward Wallace <EAW@wexlerwallace.com> wrote:

> David – will you be overseas at all? I believe Dr. Guelcher is headed that way shortly and work commitments before then are making this problematic. Can you give me a sense of your schedule so we can do what we can here?

From: David Thomas [mailto:DThomas@tcspllc.com]
Sent: Friday, August 11, 2017 2:46 PM
To: Edward Wallace <EAW@wexlerwallace.com>
Cc: Aaron Arthur <AArthur@tcspllc.com>
Subject: Guelcher

Ed—following up on dates. Thanks.

David

David B. Thomas

Thomas, Combs & Spann PLLC
300 Summers Street, Suite 1380
Charleston, WV 25301

Telephone (main)—304-414-1800
Telephone (direct)—304-414-1807

EXHIBIT F

Supplemental Data

Supplemental Materials and Methods

Fibers from an explanted polypropylene (PP) mid-urethral sling (MUS) not previously fixed in formalin were received Dr. Vladimir Iakovlev at St. Mary's Hospital (Toronto, Ontario, Canada). Fibers were supplied in numbered and sealed micro centrifuge tubes. A total of ten fibers were analyzed. Five fibers (numbered 5, 8, 23, 24, and 31) had been mechanically scraped by Dr. Iakovlev to remove tissue from the fiber surface. Another five fibers (numbered 3, 9, 11, 14, and 17) had not been scraped. Two areas were analyzed on the untreated fibers: (1) a region that appeared residue-free, and (2) a region that showed residual material. Fibers that had been cleaned were visually free of residual material, and therefore only one region of interest was examined on these fibers. Due to the small size of the fibers, no more than two independent regions could be reliably analyzed.

XPS analyses were performed in a PHI Versaprobe using Al kα x-rays (1486 eV). A 20-μm diameter x-ray spot was rastered across the analysis area, and a take-off angle of 45 degrees off sample normal was used. Pass energies of 187.7 eV and 23.5 eV were used for the low- and high resolution acquisitions, respectively. Charge neutralization was accomplished using 1.1 eV electrons and 10 eV Ar_+ ions. The energy scales of the high-resolution spectra were calibrated to place -CH2- bonding in the carbon 1s spectrum at 284.8 eV. Relative atomic concentrations were calculated using peak areas and handbook sensitivity factors. Resulting concentrations have high precision, and therefore can be used to qualitatively compare samples collected under similar conditions.

Supplemental Results

Images of fibers. Supplemental Figure 1 shows an x-ray induced secondary electron micrograph showing the area analyzed on each sample. The area indicated on the Untreated samples is that of the residue-free area. The Scraped fibers were rougher than the Untreated fibers. Therefore, the XPS analysis volume on scraped fibers included material from deeper into the fiber

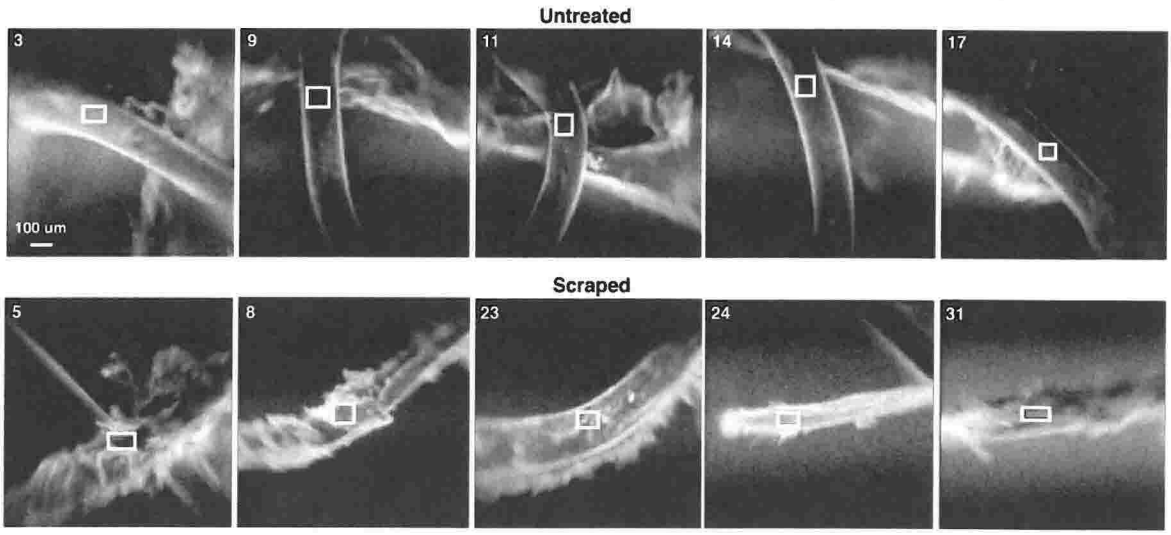

Figure S1. X-ray-induced secondary electron micrographs of the area analyzed on each fiber.

compared to fibers that had not been scraped. X-ray induced secondary electron micrographs images are not as well-defined as those obtained in an SEM because the primary x-ray beam is much larger than the electron beam used in an SEM. However, the imaging capability of this instrument enables us to define analysis areas which contain only the material of interest, which facilitates accurate interpretation of the acquired data.

Survey spectra and surface composition. A survey spectrum was collected from each fiber analyzed. Carbon, oxygen, nitrogen, and silicon were present to different degrees on all samples. Fiber number 5, which had been scraped, also contained a small amount of chlorine. Tables I and II summarize the elemental compositions determined for the Untreated and Scraped fibers, respectively. A one-way ANOVA testing the effects of surface treatment on surface chemistry found no significant ($\alpha < 0.05$) difference in atomic percents, atomic ratios, or C1s binding

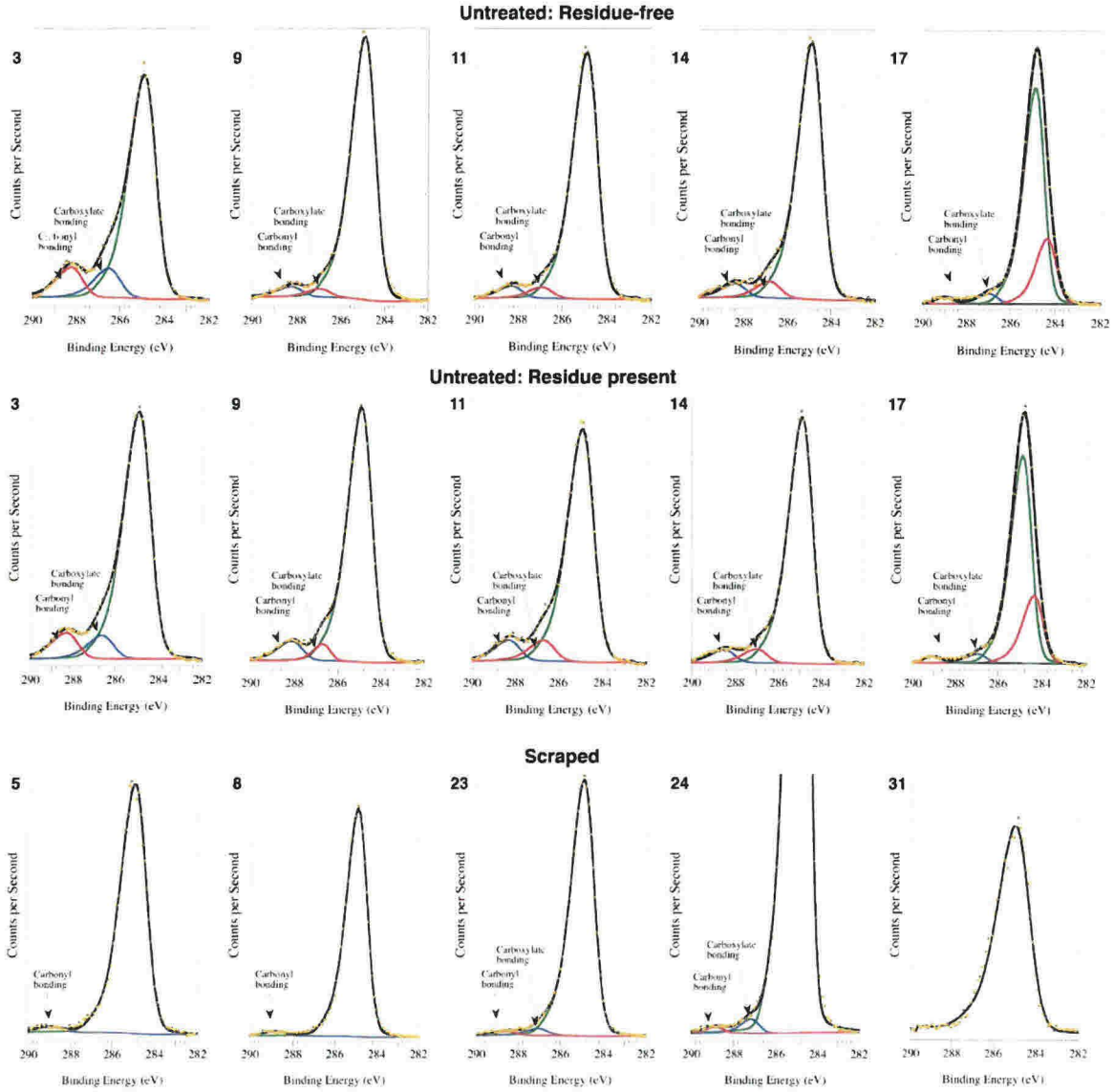

Figure S2. Survey spectra for the area analyzed on each fiber.

between residue-free and residue-present areas on the Untreated fibers. However, scraping resulted in significant differences in atomic percents, atomic ratios, and C1s bonding (Figure 4 of the manuscript). Figure S2 shows the high-resolution carbon 1s spectrum from Untreated (residue-free), Untreated (residue present), and Scraped fibers. The atomic% of carbon (C), oxygen (O), nitrogen (N), silica (Si), and chlorine (Cl) are listed in Tables S1-3.

Table S1. Summary of atomic composition of Untreated fibers (residue-free areas).

	Atomic %				
Fiber #	C	O	N	Si	Cl
3	72.7	17.7	9.5	0	0
9	84.3	11.1	4.6	0	0
11	78.3	14.4	4.2	3.0	0
14	78.2	15.7	4.3	1.7	0
17	87.4	9.7	1.1	1.8	0
Mean ± SD	80.2 ± 5.8	13.7 ± 3.3	4.7 ± 3.0	1.3 ± 1.3	0 ± 0

Table S2. Summary of atomic composition of Untreated fibers (areas with residue).

	Atomic %				
Fiber #	C	O	N	Si	Cl
3	77.5	14.2	8.3	0	0
9	81.5	13.1	5.4	0	0
11	74.9	17.3	5.4	2.4	0
14	82.9	12.6	3.9	0.6	0
17	87.7	10.3	0.0	2.0	0
Mean ± SD	80.9 ± 4.9	13.5 ± 2.6	4.6 ± 3.0	1.0 ± 1.1	0 ± 0

Table S3. Summary of atomic composition of Scraped fibers.

	Atomic %				
Fiber #	C	O	N	Si	Cl
5	93.9	6.9	0.0	0	0.2
8	93.5	5.9	0.0	0.6	0
23	93.1	5.5	0.4	1.0	0
24	97.4	2.4	0.0	0.2	0
31	96.6	3.4	0.0	0.0	0
Mean ± SD	94.9 ± 2.0	4.8 ± 1.9	0.1 ± 0.2	0.4 ± 0.4	0.1 ± 0.1

Analysis of carbon bonding. Spectra were curve-fitted to extract the contributions of different carbon bonding configurations present in the analysis area. All fibers that were not scraped exhibited some fraction of the carbon present bonded in carbonyl and carboxylate configurations. Two Scraped fibers (numbers 5 and 8) showed some carbonyl type bonding, while Scraped fibers numbered 23 and 24 contain both carbonyl and carboxylate type bonding. Figure S2 includes a spectrum of fiber 24 with an expanded y-axis to highlight the carbonyl and

carboxylate contributions to the carbon spectrum. The C1s spectrum from Scraped fiber number 31 shows no carbonyl nor carboxylate type bonding on this sample. Tables S4 – S6 summarize the percent of C1s bonding configurations present on each Untreated (residue-free and residue-present) and Scraped fibers, respectively.

Table S4. Summary of relative amounts (%) of the various C 1s bonding configurations present on the residue-free areas of Untreated fibers.

Fiber #	≈288 eV C=O	≈287 eV R-C*COOH	≈284.8 eV -CH	≈284.3 eV
3	10.6	10.3	78.9	ND
9	3.7	7.9	93.2	ND
11	4.5	4.2	91.3	ND
14	5.0	5.8	89.2	ND
17	1.9	3.5	72.6	21.9
Mean ± SD	5.1 ± 3.3	6.3 ± 2.8	85.0 ± 8.9	4.4 ± 9.8

Table S5. Summary of relative amounts (%) of the various C 1s bonding configurations present on the residue-present areas of Untreated fibers.

Fiber #	≈288 eV C=O	≈287 eV R-C*COOH	≈284.8 eV -CH	≈284.3 eV
3	8.9	6.9	83.2	ND
9	6.9	3.0	88.9	ND
11	7.6	7.7	84.7	ND
14	4.8	5.2	90.0	ND
17	1.8	3.2	71.6	23.5
Mean ± SD	6.0 ± 2.8	5.2 ± 2.1	83.7 ± 7.3	4.7 ± 10.5

Table S6. Summary of relative amounts (%) of the various C 1s bonding configurations present on Scraped fibers.

Fiber #	≈288 eV C=O	≈287 eV R-C*COOH	≈284.8 eV -CH	≈284.3 eV
5	ND	2.5	97.5	ND
8	ND	2.3	97.7	0.6
23	1.5	2.6	95.9	1.0
24	0.4	1.2	98.4	0.2
31	ND	ND	100	0.0
Mean ± SD	0.4 ± 0.6	1.7 ± 1.1	0.1 ± 0.2	97.9 ± 1.5

EXHIBIT G

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF WEST VIRGINIA

AT CHARLESTON

IN RE: ETHICON, INC., PELVIC REPAIR SYSTEM PRODUCTS LIABILITY LITIGATION	**Master File No. 2:12-MD-02327**
THIS DOCUMENT RELATES TO **WAVE 5 CASES**	**JOSEPH R. GOODWIN** **U.S. DISTRICT JUDGE**

EXPERT REPORT OF SCOTT GUELCHER, PH.D.

The opinions which are held and expressed to a reasonable degree of scientific certainty are as follows:

I. QUALIFICATIONS

Scott Guelcher, Ph.D.

I received my Bachelor's Degree in Chemical Engineering from Virginia Tech in 1992, my Master's Degree in Chemical Engineering from the University of Pittsburgh in 1996, and my Ph.D. in Chemical Engineering from Carnegie Mellon University in 1999. I completed my training as a Post-Doctoral Research Associate in Biomedical Engineering at Carnegie Mellon University in 2005.

I am currently a Professor of Chemical and Biomolecular Engineering at Vanderbilt University. Prior to my current appointment, I was an Associate Professor from 2012 through 2016 and an Assistant Professor from 2005 through 2012. I was recently appointed a Chancellor's Faculty Fellow for the period 2015 – 2017, and in December 2016 I was appointed the Director of the Vanderbilt Center for Bone Biology in the Department of Medicine at Vanderbilt University Medical Center. In 2016, I taught Design Projects (Spring) and Applied Chemical Kinetics (Fall). In 2017, I am teaching Design Projects (Spring).

My professional experience includes: Associate Scientist and Senior Associate Scientist at Bayer Corporation, Polyurethanes Division, in South Charleston, West Virginia from 1999-2003; Trainee at Philips Research, in Eindhoven, The Netherlands in 1998; Limited Service Employee at Eastman Chemical Co. from 1995-1997; and Chemical Engineer at Eastman Chemical Co. from 1992-1994. I am active in several professional societies, including the American Institute of Chemical Engineers, the American Chemical

Society, the Society for Biomaterials, the Cancer and Bone Society, and the Interdisciplinary Research Society for Bone and Joint Injectable Biomaterials. My research interests include biomaterials design and development, drug and gene delivery, tissue engineering, and *in vitro* models for cancer metastasis to bone.

My experience, education and training and a complete list of my published articles are summarized in my Curriculum Vitae attached to this report as Exhibit A. I have published 83 peer-reviewed articles, including four on the design of scaffolds that degrade in response to secretion of reactive oxygen species and two on oxidation and degradation of polypropylene pelvic mesh. I also have experience in the design of biologic and tissue-engineered grafts for regeneration of cutaneous tissue and bone, having published 24 peer-reviewed papers on biologic tissue grafts. I have co-authored 9 book chapters, given 53 invited presentations, and co-authored 184 abstracts presented at scientific meetings, two of which relate to oxidation of polypropylene in biomedical devices. I am a co-inventor on 11 issued U.S. and European Patents and 20 pending applications.

II. SUMMARY OF OPINIONS

This report is an examination and assessment of the polypropylene mesh utilized in devices manufactured by Ethicon to treat Stress Urinary Incontinence (SUI) and pelvic organ prolapse (POP). All of the opinions presented herein are made to a reasonable degree of scientific certainty and within my field of expertise.

1) Polypropylene reacts with molecular oxygen by autoxidation outside the body at elevated temperatures, resulting in chain scission and deterioration in its mechanical properties;

2) After implantation in the body, polypropylene reacts with reactive oxygen species secreted by inflammatory cells, resulting in oxidation, chain scission and mesh embrittlement;

3) The dynamic environment where the polypropylene mesh is implanted coupled with the foreign body reaction leads to oxidation, chain scission, reduction in molecular weight, embrittlement, degradation, flaking, pitting, and cracking;

4) The human body does not stop responding to an implanted mesh, or any frayed particles of mesh released during implantation, unless the product is removed in its entirety;

5) The mesh devices examined for this report are intended to last for the lifetime of the patient, but the presence of antioxidants does not permanently protect the PP against degradation, and thus it is not possible to guarantee that it will perform its intended function after implantation;

6) The effects of oxidation on the stability of Prolene were known to Ethicon prior to launching its SUI and POP devices, but the company did not consider the risks associated with polypropylene oxidation on the stability of Prolene mesh, to the detriment of patients implanted with the devices;

7) Polypropylene mesh is not inert and its properties change after implantation, which can lead to adverse events in an implantee; the use of heavy-weight meshes directly correlates with more exposure of polypropylene to the Foreign Body Reaction and greater changes after implantation, which increases the risk of complications.

8) Using autologous fascia lata, allograft, sutures (including polypropylene sutures), or polyvinylidene fluoride (PVDF) mesh does not present with the same chronic complications associated with the material properties of Ethicon's PP mesh. All of these alternative materials, including using a less dense version of its PP mesh, were available when Ethicon's SUI and POP meshes were first commercialized.

III. BACKGROUND

Ethicon sells permanently implantable polypropylene-based meshes intended to treat Stress Urinary Incontinence (SUI) and Pelvic Organ Prolapse (POP). All of the products in this litigation use the same Prolene resin to make the polypropylene-based meshes examined in this report.[1] Prolene was developed by Ethicon in the late 1960s for use as a suture material[2] and is more than 97% polypropylene. Additives are blended with polypropylene to modify its properties, including the antioxidants dilauralthiodipropionate (DLTDP) and Santonox-R to protect Prolene during high-temperature processing and long-term storage[3], and the blue pigment copper phthalocyanate (CPC) to enhance its visibility.[4] Prolene resin is manufactured as pellets, which are extruded into monofilaments that are subsequently knit into a specific mesh pattern.[5]

Ethicon's SUI devices consist of their instructions for use (IFU), insertion tools, and a high-density mesh (105 g/m^2) knit from Prolene monofilaments that are 6 mil (0.006 inches) in diameter.[6] The Prosima, Prolift, and Gynemesh POP devices all consist of their IFU, insertion tools, and a lower density mesh (45 g/m^2, known as Gynemesh[7]) knit from Prolene monofilaments that are 3.5 mil (0.0035 inches) in diameter.[8] The mesh used in the Prolift+M POP device is a hybrid material comprising a blend of absorbable Monocryl (poly(glycolide-*co*-ε-caprolactone)) and Prolene. After the Monocryl is absorbed, the density of the remaining Prolene mesh is 28 g/m^2.[9]

[1] ETH.MESH.04941016; ETH.MESH.01310578; ETH.MESH.03987419; ETH.MESH.07876572; ETH.MESH.00019863; ETH.MESH.0181699
[2] ETH.MESH.02268619
[3] ETH.MESH.02268619
[4] *Id.*
[5] ETH.MESH. 03987419; ETH.MESH.01310578
[6] ETH.MESH.04941016
[7] ETH.MESH.01310578
[8] ETH.MESH.00074499
[9] *Id.*

IV. DISCUSSION

1) Polypropylene reacts with molecular oxygen outside the body by the process of autoxidation

Polypropylene (PP) is a plastic that is formed by a chemical reaction that joins the monomer propylene (which is composed of three carbon atoms and six hydrogen atoms) into a long repeating chain in a process called polymerization.[10] All forms of PP are susceptible to oxidation at the tertiary hydrogen-carbon bond.[11]

Oxidative attack at the tertiary hydrogen bond is the rate-controlling step in degradation process and results in the PP molecular chain being broken, a process known as chain scission, with the consequent loss in molecular weight. The mechanism of PP autoxidation is shown in Figure 1.[12] The process is autocatalytic, resulting in generation of more PP radicals (PP•) as the reaction progress. Thus, the reaction continues until no more PP can be broken down. The mechanism of PP autoxidation has been investigated extensively since the 1960s and was well known at the time that Ethicon was designing the mesh used in SUI and POP products. As shown in Figure 1, the products of autoxidation include shorter PP chains with carbonyl (C=O) and hydroperoxide (COOH) groups covalently bound to the PP. The presence of these groups can be detected by surface techniques such as FTIR and x-ray photoelectron spectroscopy (XPS) as evidence of

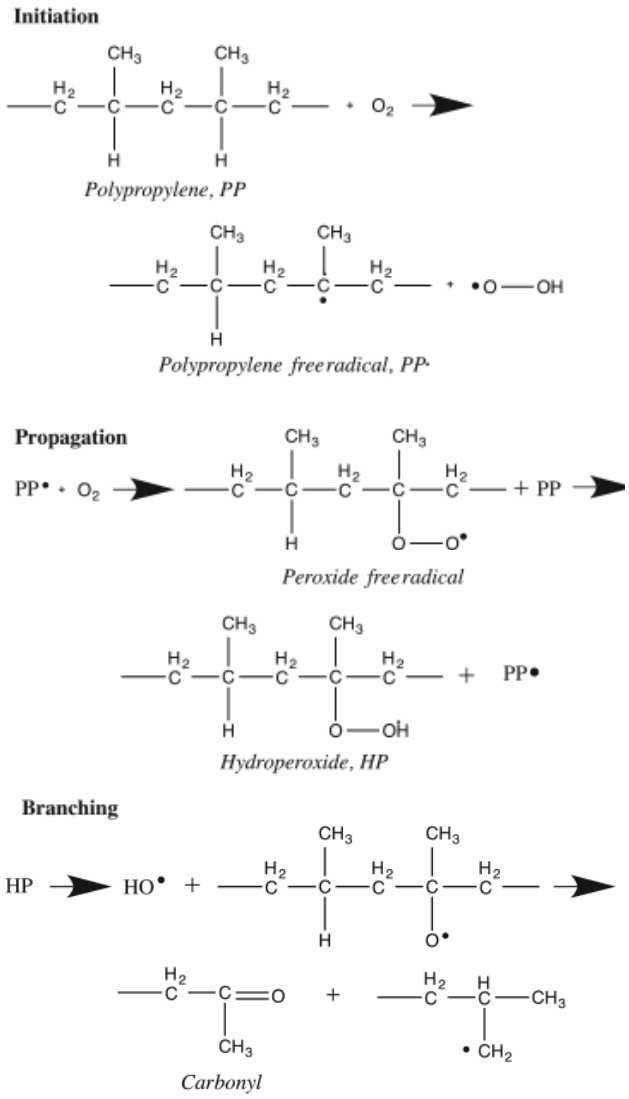

Figure 1. Mechanism of PP autoxidation. Initiation, propagation, and branching reactions lead to chain scission (loss of molecular weight). Products from autoxidation include hydroperoxide and carbonyl groups, which can be detected by analytical methods such as FTIR.

[10] EA Campo. Industrial Polymers. Hanser 2008, p. 74.
[11] HH Kausch. The effect of Degradation and Stabilization on the Mechanical Properties of Polymers Using Polypropylene Blends as the Main Example. *Macromol. Symp*. 225:165-178, 2005.
[12] Reference for Figure 1: C Maier, T Calafut. Polypropylene: The Definitive User's Guide and Databook. Norwich, NY: Plastics Design Library, 1998.

oxidation.[13]

As shown in Figure 2, heat and UV radiation accelerate oxidation of PP.[14] Absorption of oxygen is diffusion-controlled, and the amorphous regions of the semi-crystalline PP are the most accessible to diffusion of O_2. The amorphous phase of PP comprises non-crystallizable segments of the PP chains as well as tie molecules that connect two neighboring crystalline domains. Since the toughness of PP depends on the number of tie molecules, cutting of the tie molecules during autoxidation is the primary factor contributing to embrittlement. The key features of oxidation of PP, in terms of the amount of molecular weight loss that is critical for embrittlement to occur are summarized in Figure 3.[15] An important finding from this study is that embrittlement occurs much earlier (~150 hours) than the induction time (~250 hours) determined by the concentration of carbonyl groups and hydroxyl groups associated with the hydroperoxide (COOH) under these conditions. Thus, the induction time overestimates the useful life of PP with respect to its mechanical properties.

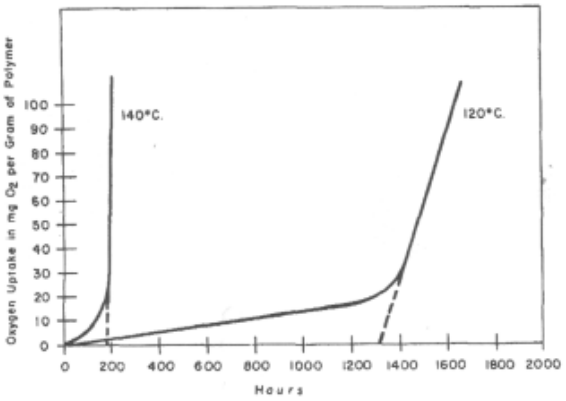

Figure 2. Autoxidation of PP is accelerated at elevated temperatures. Oxygen absorption of stabilized PP increases with time and temperature in 100% O_2. The induction time is determined by extrapolating the autocatalytic constant rate portion of the curve (steeper slope) to the x-axis (dashed line). Reproduced from Oswald and Turi 1965.

The storage stability of unstabilized PP at ambient conditions has also been studied (Figure 4). When PP films were stored at room temperature and atmospheric O_2 concentration, the molecular weight (as measured by intrinsic viscosity) of PP dramatically decreased at 500 days (1.4 years).[16] Thus, while oxidation is accelerated at elevated temperatures and oxygen concentrations (Figure 2), even at ambient temperature and atmospheric oxygen concentration there is chain scission and molecular weight loss.

2) After implantation in the body, polypropylene reacts with reactive oxygen species secreted by inflammatory cells, resulting in oxidation, chain scission and mesh embrittlement;

Liebert et al.[17] (1976) reported the oxidation of unstabilized PP filaments in vivo in a subcutaneous implantation model in hamsters. An induction time of 108 days was determined based on FTIR measurements of hydroxyl (which includes the hydroperoxide

[13] B Fayolle, L Audouin, J Verdu. Oxidation-induced embrittlement in polypropylene – a tensile testing study. *Polym Degrad Stability* 70:333-40, 2000.
[14] HJ Oswald, E. Turi. The Deterioration of Polypropylene by Oxidative Degradation. *Polymer Engineering and Science*, 1965.
[15] B Fayolle, L Audouin, J Verdu. Oxidation-induced embrittlement in polypropylene – a tensile testing study. *Polym Degrad Stability* 70:333-40, 2000.
[16] HJ Oswald and E. Turi. The Deterioration of Polypropylene by Oxidative Degradation. *Polymer Engineering and Science*, 1965.
[17] TC Liebert, RP Chartoff, SL Cosgrove, RS McCuskey. Subcutaneous implants of polypropylene filaments. *Journal Biomedical Materials Research* 10:939-51, 1976.

COOH) and carbonyl groups. FTIR measurements of hydroxyl and carbonyl groups showed behavior similar to that observed by Fayolle (Figure 3), consistent with the oxidation mechanism. However, Liebert estimated that the induction time for oxidation under *in vivo* conditions (37°C in 3.3% O_2) is approximately 20 years, which is dramatically higher than the measured value of 108 days. The authors suggested that enzymes or other chemicals secreted by cells accelerate the oxidation reaction. Recent papers have shown that this shorter induction time can be explained by the secretion of reactive oxygen species (ROS) by inflammatory cells near the PP fibers that oxidize and degrade the PP fibers *in vivo*.

Upon implantation, the body recognizes PP mesh as a foreign body, which elicits an inflammatory response known as the foreign body reaction. [18] In the early stages, mononuclear cells migrate to the surface of the PP fibers, where they can adhere and participate in the events of the foreign body reaction (Figure 5). Adherent macrophages on the surface of the implanted biomaterial fuse to form foreign body giant cells (FGBCs). Adhesion of macrophages and FBGCs at the biomaterial surface results in an isolated microenvironment between the surface of the biomaterial and the plasma membrane of the cell.[19] In a process known as frustrated phagocytosis, macrophages and FBGCs secrete reactive oxygen species (ROS), acids, and enzymes into this micro-environment. Consequently, the surface of the biomaterial is exposed to high concentrations of ROS, and the chemical composition of the biomaterial will determine its susceptibility to oxidative degradation. As an example, the polyether soft segment of poly(ether urethane)s is known to undergo oxidative degradation. The morphological progression of the foreign body reaction on a poly(ether urethane) surface is shown in Figure 6. [20]

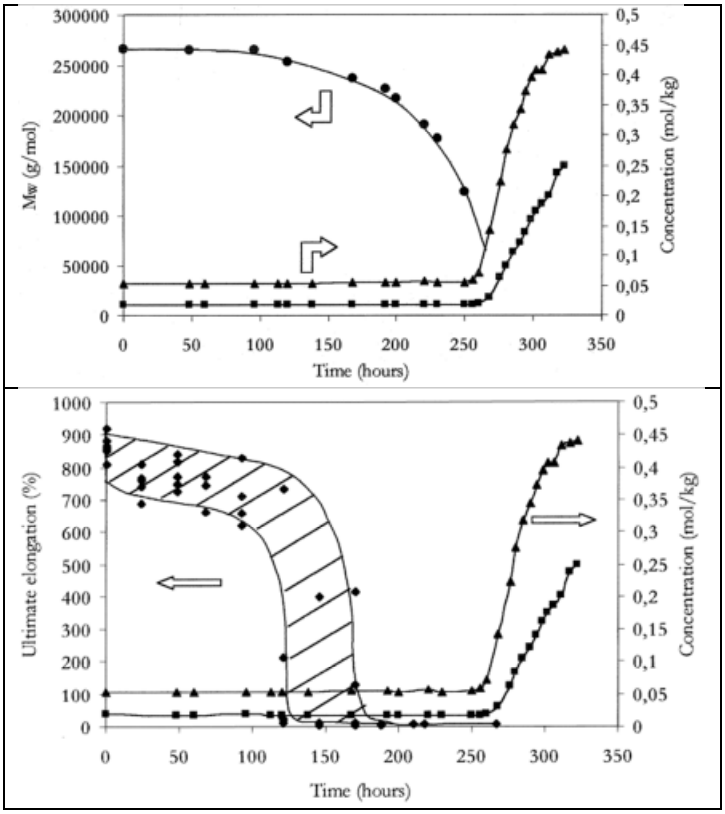

Figure 3. Degradation of unstabilized PP. (A) Molecular weight decreases with time when exposed to oxygen at elevated temperatures (Fayolle et al. 2000). On the right y-axis, the concentration of hydroxyl (triangles) and carbonyl (squares) groups are shown. (B) Evolution of ultimate elongation (diamonds) and hydroxyl (triangles) and carbonyl (squares) groups during exposure to oxygen at elevated temperatures (Fayolle et al. 2000).

[18] JM Anderson, A Rodriguez, DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol.* 20(2): 86–100, 2008.
[19] *Id.*
[20] *Id.*

While initial studies identifying adherent macrophages and FBGCs as sources of ROS focused on poly(ether urethane)s, these cell populations have also been reported to infiltrate PP mesh.[21] In a recent study characterizing the foreign body reaction of PP implants in a rat abdominal wall model, macrophages and foreign body giant cells were observed both in the tissue surrounding the implant and also the implant itself.[22] Thus, within one week after implantation PP mesh was colonized by macrophages and FBGCs. Furthermore, PP mesh samples showed more inflammatory cells than PP sutures. The hernia literature also provides evidence that the foreign body reaction alters PP *in vivo*. In a study evaluating non-degradable meshes explanted from 17 patients that had surgery for repair of abdominal wall defects, a foreign body reaction characterized by granulation tissue and inflammatory cells 3 – 24 months post-implantation was seen.[23] The authors observed that inflammation near synthetic materials implanted in the abdominal wall persists for years. They further noted that this persistent foreign body reaction can lead to long-term complications, and that further studies are required to evaluate the long-term response of the host tissue to the implanted synthetic graft. Costello et al. also examined explanted PP hernia mesh and noted that the observed degradation of PP fibers was consistent with the oxidation of PP mediated by phagocytic cells during the foreign body reaction.[24]

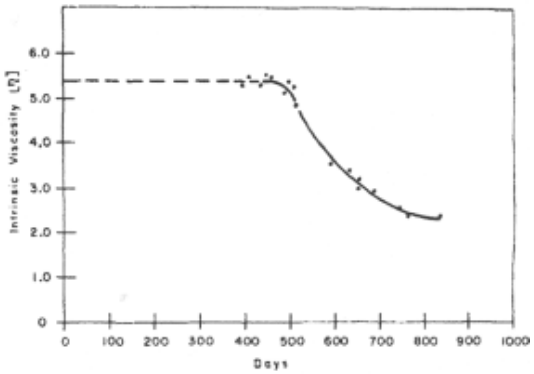

Figure 4. Stability of unstabilized PP at room temperature. Significant molecular weight loss occurs at 500 days. Reproduced from Oswald and Turi 1965.

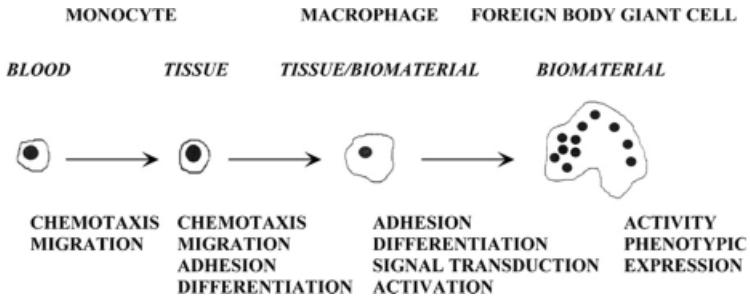

Figure 5. *In vivo* transition from blood-borne monocyte to biomaterial adherent monocyte/macrophage to foreign body giant cell at the tissue/biomaterial interface. There is ongoing research to elucidate the biological mechanisms that are considered to play important roles in the transition to foreign body giant cell development. From Anderson et al. Seminars in Immunology 2008.

[21] C Mary, Y Marois, MW King, G Laroche, Y Douville, L Martin, R Guidoin. Comparison of the In Vivo Behaviour of Polyvinylidene Fluoride and polypropylene Sutures Used in Vascular Surgery. *ASAIO Journal* 44:199-206, 1998; VV Iakovlev, ET Carey, J Steege. Pathology of Explanted Transvaginal Meshes. *Int. J. Medical, Health, Pharmaceutical and Biomedical Eng*. 8(9):510-513, 2014

[22] ML Konstantinovic, E Pille, M Malinowska, E Verbeken, D De Ridder, J Deprest. Tensile strength and host reponse towards different polypropylene implant materials used for augmentation of fascial repair in a rat model. *Int Urogynecol J* 18:619-26, 2007.

[23] U Klinge, B Klosterhalfen, M. Müller, V Schumpelick. Foreign Body Reaction to Meshes Used for the Repair of Abdominal Wall Hernias. *Eur J Surg* 165: 665–673, 1999.

[24] CR Costello, SL Bachman, BJ Ramshaw, SA Grant. Materials Characterization of Explanted Polypropylene Hernia Meshes. *J. Biomed. Mater Res. Part B Appl. Biomat* 83:44-49, 2007; CR Costello, SL Bachman, SA Grant, DS Cleveland, TS Loy, BJ Ramshaw. Characterization of Heavyweight and Lightweight Polypropylene Prosthetic Mesh Explants from a Single Patient. *Surg. Innov*. 14:168-76, 2007.

Three key studies published in 2015 that characterize the host inflammatory response to implanted PP provide further evidence that PP mesh undergoes oxidative degradation *in vivo*. Gynemesh PS and UltraPro, which are Prolene meshes used in Ethicon's POP products, were implanted in rhesus macaques by sacrocolpopexy after an abdominal hysterectomy.[25] After 12 weeks implantation time, the vagina-mesh tissue complexes were harvested and processed for histological and immunohistochemical analysis. Explanted Gynemesh PS and UltraPro meshes showed evidence of a foreign body reaction characterized by a dense mononuclear cell infiltrate near the surface of the mesh fibers. Mononuclear cells staining positive for the pan-macrophage marker CD68 were the cell type present at the highest density adjacent to the mesh fibers. The inflammatory response to all implanted PP meshes was characterized primarily by activated, pro-inflammatory M1 macrophages (an example of macrophages on Elasthane 80A are shown in Figure 7, Top Left).[26] The ratio of regenerative M2 macrophages to M1 macrophages was higher for the lower density UltraPro mesh compared to the

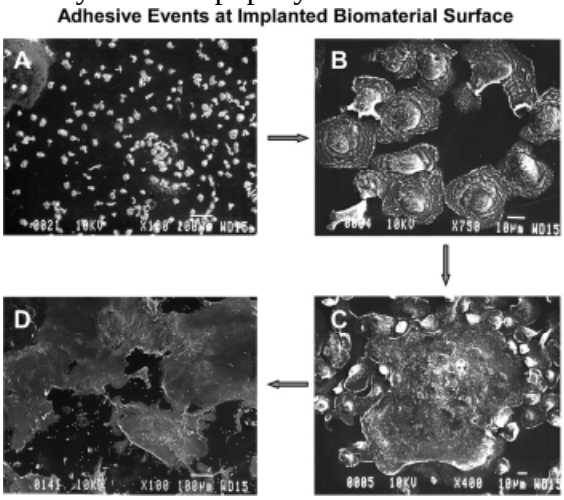

Figure 6. Scanning electron microscopy images of an Elasthane 80A Polyurethane surface from an in vivo cage study showing the morphological progression of the foreign body reaction. The sequence of events at the Polyurethane surface includes (A) monocyte adhesion (0 days), (B) monocyte-to-macrophage development (3 days), (C) ongoing macrophage-macrophage fusion (7 days), and (D) foreign body giant cells (14 days). From JM Anderson, A Rodriguez, DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol.* 20(2): 86–100, 2008.

[25] BN Brown, D Mani, AL Nolfi, R Liang, S Abramowitch, PA Moalli. Characterization of the host inflammatory response following implantation of prolapse mesh in rhesus macaque. *Am J Obstet Gynecol*. 213(5):668.e1-668.e10, 2015.

[26] JM Anderson, A Rodriguez, DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol.* 20(2): 86–100, 2008.

higher density Gynemesh PS. This finding is consistent with the mesh burden concept that the magnitude of the foreign body reaction increases with the amount of mesh in contact with host tissue. Thus, the work by Moalli et al. establishes that the foreign body reaction to implanted PP mesh is dominated by pro-inflammatory M1 macrophages. In a study I co-authored with Dr. Vladimir Iakovlev in 2015, we examined 164 explanted PP pelvic meshes by microscopy.[27] Examination of histological sections revealed the presence of inflammatory cells near the surface of PP fibers, and staining for the oxidative enzyme myeloperoxidase expressed by adherent inflammatory cells was positive on the surface of the

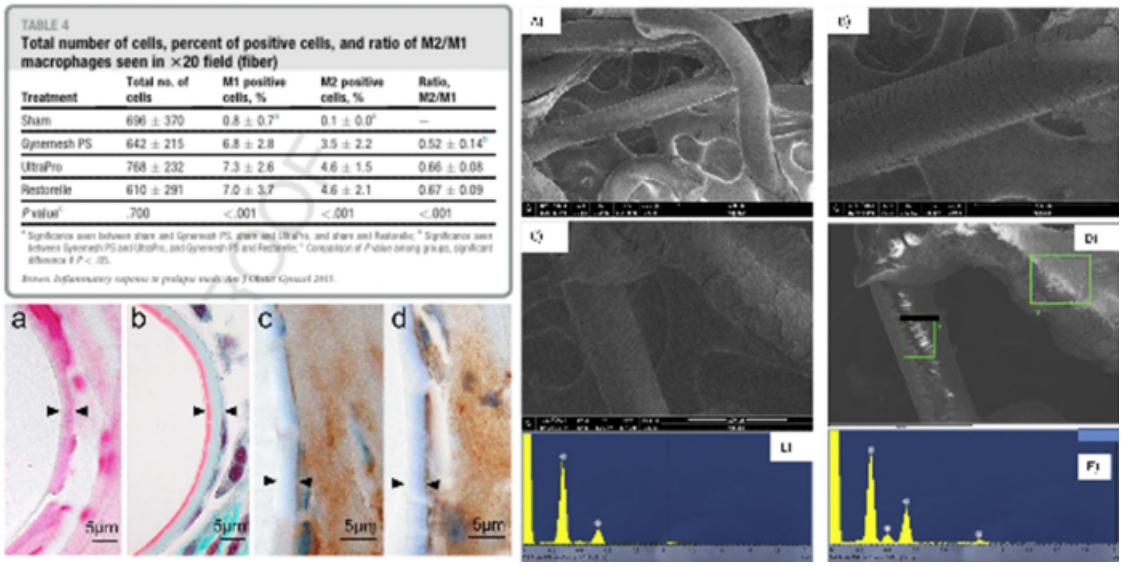

TABLE 4
Total number of cells, percent of positive cells, and ratio of M2/M1 macrophages seen in ×20 field (fiber)

Treatment	Total no. of cells	M1 positive cells, %	M2 positive cells, %	Ratio, M2/M1
Sham	696 ± 370	0.8 ± 0.7[a]	0.1 ± 0.0[a]	–
Gynemesh PS	642 ± 215	6.8 ± 2.8	3.5 ± 2.2	0.52 ± 0.14[b]
UltraPro	768 ± 232	7.3 ± 2.6	4.6 ± 1.5	0.66 ± 0.08
Restorelle	610 ± 291	7.0 ± 3.7	4.6 ± 2.1	0.67 ± 0.09
P value[c]	.700	<.001	<.001	<.001

[a] Significance seen between sham and Gynemesh PS, sham and UltraPro, and sham and Restorelle. [b] Significance seen between Gynemesh PS and UltraPro, and Gynemesh PS and Restorelle. [c] Comparison of *P* value among groups; significant difference if *P* < .05.

Brown. Inflammatory response to prolapse mesh after 3 months. Obstet Gynecol 2015.

Figure 7. Oxidative degradation of PP mesh *in vivo*. Top Left: Table listing the total number of cells, percent of positive cells, and ratio of M2/M1 macrophages seen in x20 field (fiber) (Moalli et al., Characterization of the host inflammatory response following implantation of prolapse mesh in rhesus macaque.) Bottom Left: Additional stains of PP mesh, all images taken with 100x oil immersion objective and cropped to a different magnification, polypropylene degrada-tion layer is pointed between arrowheads: (a) Von Kossa stain is negative for calcium in the brittle "bark" (would stain calcium black), (b) trichrome stain shows that the deeper parts of the "bark" have smaller staining porosity (red) than those close to the surface (green) which correlates with TEM findings [Figure 6(b)], (c) immunohistochemical stain for immunoglobulin G (IgG, stained brown). IgG is present in almost all human tissues and fluids. It is deposited on the surface of degraded polypropylene but is not mixed within it. (d) Immunostain for the oxidizing enzyme of inflammatory cells myeloperoxidase (stains brown). (VV Iakovlev. *In vivo* degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients.) Right: A) SEM of explanted Pinnacle Mesh fibers [XP-7]. B) SEM of explanted Pinnacle Mesh fibers [XP-7]. C) SEM of explanted Pinnacle Mesh fibers [XP-7]. D) SEM image with regions selected for EDS. E) EDS Spectra from region 1 in D. F) EDS Spectra from region 2 in D. (A Imel, T Malmgren, M Dadmun, S. Gido, J Mays. In vivo oxidative degradation of polypropylene pelvic mesh, *Biomaterials*, 2015.).

degraded layer of the PP fibers (Figure 7, Bottom Left). Another study published in 2015 confirmed that the foreign body reaction to implanted PP mesh results in oxidative degradation of the mesh.[28] PP pelvic meshes explanted from 11 patients were characterized by FTIR, GPC, SEM with energy-dispersive x-ray spectroscopy (EDS), TEM, and TGA and compared to meshes that had not been implanted. FTIR spectra of explanted PP mesh showed broad peaks centered at 3400 cm^{-1}, which correspond to hydroxyl and peroxide groups, and at 1700 – 1750 cm^{-1}, which correspond to carbonyl

[27] VV Iakovlev, SA Guelcher, R Bendavid. *In vivo* degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *J Appl Biomed Mater Res B: Appl Biomater* 105(2):237-248, 2017.

[28] A Imel, T Malmgren, M Dadmun, S. Gido, J Mays. In vivo oxidative degradation of polypropylene pelvic mesh. *Biomaterials* 73:131-141, 2015.

groups associated with ketones, aldehydes, and carboxylic acids. Importantly, this study demonstrated that oxidized PP, which does not contain nitrogen, and biological material, which does contain nitrogen, could be distinguished by a combination of EDS and SEM. Regions of PP fibers with transverse cracks that were free of biological material were found to contain oxidized PP (Figure 7 Right). Furthermore, clean PP fibers that showed no evidence of transverse cracking revealed evidence of PP oxidation.

Two recent studies by the Moalli group at the University of Pittsburgh have reported the effects of PP mesh on host tissue and the inflammatory response. When PP mesh was implanted in the vaginal wall of rhesus macaques, mesh stiffness and density were negatively correlated with muscle outcomes, including myofiber function, contraction, and innervation.[29] Moalli et al. also examined the inflammatory response in fifteen SUI and twelve POP meshes explanted from 27 women, including two TVT meshes.[30] Histological analysis revealed evidence of macrophages, which were predominantly of the M1 pro-inflammatory phenotype, surrounding PP mesh fibers. Matrix metalloproteinase-9 (MMP-9) and MMP-2, which are associated with chronic inflammation, were significantly upregulated in mesh-vagina explants compared to vaginal tissue without mesh.[31] Mesh explants that were removed due to exposure exhibited significantly higher pro-MMP-9 than those removed due to pain. These findings show that mesh exposure correlates with expression of factors associated with inflammation.

In a manuscript recently accepted for publication, I have shown that PP mesh oxidizes and degrades *in vitro*. [32] TVT, Advantage (Boston Scientific), and Lynx (Boston Scientific) mesh specimens were incubated in oxidative medium that mimics the reactive oxygen species (ROS) secreted by adherent inflammatory cells. [33] PP oxidized and degraded *in vitro* in the absence of proteins, as evidenced by the appearance of oxygen (measured by FTIR) and pitting, peeling, and flaking on the surface (measured by SEM). In a patient explant, manual dissection of mesh not fixed in formalin successfully removed protein

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[29] Z Jallah, R Liang, A Feola, W Barone, S Palcsey, SD Abramowitch, N Yoshimura, and P Moalli. The impact of prolapse mesh on vaginal smooth muscle structure and function. *BJOG* 23:1076–1085, 2016.

[30] AL Nolfi, BN Brown, R Liang, SL Palcsey, MJ Bonidie, SD Abramowitch, PA Moalli. Host response to synthetic mesh in women with mesh complications. *Am J Obstet Gynecol* 215:206.e1-8, 2016.

[31] *Id.*

[32] AD Talley, BR Rogers, V Iakovlev, RF Dunn, and SA Guelcher. Oxidation and degradation of polypropylene transvaginal mesh. *Journal of Biomaterials Science: Polym Ed* 28(5):444-458, 2017.

[33] QH Zhao, AK McNally, KR Rubin, M Renier, Y Wu, V Rose-Caprara, JM Anderson, A Hiltner, P Urbanski, K Stokes. Human plasma macroglobulin promotes in vitro oxidative stress cracking of Pellethane 2363-80A: In vivo and in vitro correlations. *J Biomed Mater Res* 27: 379-389, 1993.AE Hafeman, KJ Zienkiewicz, AL Zachman, HJ Sung, LB Nanney, JM Davidson, SA Guelcher. Characterization of degradation mechanisms of biodegradable lysine-derived aliphatic polyurethanes. *Biomaterials* 32(2):419-29, 2011. JL Martin, MK Gupta, JM Page, F Yu, JM Davidson, SA Guelcher, CL Duvall. Synthesis of a Porous, Biocompatible Tissue Engineering Scaffold Selectively Degraded by Cell-Generated Reactive Oxygen Species. *Biomaterials* 35(12):3766-76, 2014. MAP McEnery, S Lu, MK Gupta, KJ Zienkiewicz, JC Wenke, K Kalpakci, D Shimko, CL Duvall, SA Guelcher. Resorbable Poly(thioketal urethane)/Ceramic Composite Bone Cements with Bone-Like Strength. *RSC Advances* 6:109414 - 109424, 2016. JR Martin, CE Nelson, MK Gupta, F Yu, KM Hocking, JM Davidson, SA Guelcher, CL Duvall. Local delivery of PHD2 siRNA from ROS-degradable scaffolds to promote diabetic wound healing. *Adv Healthc Mater* 5(21):2751-2757, 2016.

from the surface, revealing an underlying layer of oxidized PP. XPS analysis of these mechanically scraped fibers showed negligible nitrogen but a significant amount of oxygen on the surface. Furthermore, oxygen was present in C=O and COOH bonds as predicted by the oxidation mechanism. These findings cannot be explained by the notion that the surface is coated by a crosslinked protein-formaldehyde complex as proposed by Thames et al [34], since the samples were never fixed in formalin.

Thames et al. recently published a study reporting that the surface of PP is coated by a crosslinked protein-formaldehyde complex.[35] However, both internal Ethicon studies from the 1980s as well as recently published papers have reported that the surface cracked layer is a complex composite of oxidized PP and adsorbed protein. Thus, while the Thames et al. cleaning protocol may be adequate for removing all of the adsorbed protein, it is not sufficient to characterize the composition and structure of the surface cracked layer. Alternative cleaning procedures that remove only the proteins in the "layer structure" should be used to avoid removing the "protein trapped by microcracks"[36] (Figure 8), which enables a more rigorous analysis of the surface cracked layer. Procedures previously used to clean PP sutures, hernia mesh, and pelvic mesh utilized sodium hypochlorite (bleach) solution, enzymatic solutions, or Soluene[37] to selectively remove proteins and tissue from the "layer structure" (Figure 1). Recommended protocols for analyzing explanted biomedical devices are described in ISO 12891. While no method is listed for cleaning PP explants, the standard recommends cleaning with sodium hypochlorite (bleach) solution for the closely related polyolefin, ultra-high molecular weight polyethylene.[38] In contrast, sonication is used to clean metals and jewels, remove dental plaque, and pulverize renal calculi.[39] Consequently, sonication for long periods of time (as reported by Thames et al.[40]) can remove all detachable materials non-specifically, and is therefore not suitable for investigating the composition and structure of the surface

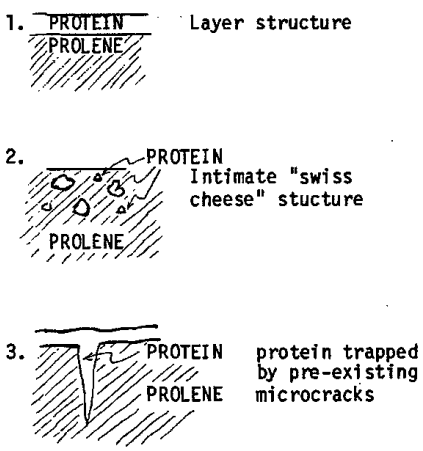

Figure 8. Three protein deposition mechanisms proposed by Dr. Peter Moy. ETH.MESH.15958445

[34] SF Thames, JB White, KL Ong. The myth: in vivo degradation of polypropylene-based meshes. *Int Urogynecol J* 28(2):285-297, 2017. M Thompson, SA Guelcher, R Bendavid, V Iakovlev, DR Ostergard. In vivo polypropylene mesh degradation is hardly a myth. *Int Urogynecol J* 28(2):333-335, 2017. SF Thames, JB White, KL Ong KL. Reply to "In vivo polypropylene mesh degradation is hardly a myth". *Int Urogynecol J* 28(2):337-338, 2017.

[35] SF Thames, JB White, KL Ong. The myth: in vivo degradation of polypropylene-based meshes. *Int Urogynecol J* 28(2):285-297, 2017. M Thompson, SA Guelcher, R Bendavid, V Iakovlev, DR Ostergard. In vivo polypropylene mesh degradation is hardly a myth. *Int Urogynecol J* 28(2):333-335, 2017. SF Thames, JB White, KL Ong KL. Reply to "In vivo polypropylene mesh degradation is hardly a myth". *Int Urogynecol J* 28(2):337-338, 2017.

[36] ETH.MESH.15958445.

[37] http://www.perkinelmer.com/product/soluene-350-0-5-l-6003038

[38] A Imel, T Malmgren, M Dadmun, S. Gido, J Mays. In vivo oxidative degradation of polypropylene pelvic mesh. *Biomaterials* 73:131-141, 2015

[39] M Thompson, SA Guelcher, R Bendavid, V Iakovlev, DR Ostergard. In vivo polypropylene mesh degradation is hardly a myth. *Int Urogynecol J*. 28(2):333-335, 2017.

[40] SF Thames, JB White, KL Ong. The myth: in vivo degradation of polypropylene-based meshes. *Int Urogynecol J*. 28(2):285-297, 2017.

cracked layer. Dan Burkley, an Ethicon employee, noted the appearance of the surface scrapings form explanted Prolene sutures as resembling a "waxy snow" [41], which implies a friable material and is in agreement with a recent study reporting that the surface of explanted PP mesh fibers is cracked and porous.[42] Step #8 of the Thames et al. cleaning protocol comprised immersion in bleach solution in an ultrasonic bath for 1.5 h. This step is the second bleach treatment, after which the peaks ranging from 1500 – 1750 cm^{-1}, which are associated with carbonyl groups in proteins and oxidized PP, disappeared from the FTIR spectrum. This observation is consistent with the notion that sonication non-selectively debrides the surface of the PP fiber and removes all adherent material, including adsorbed proteins and oxidized PP. Thames et al. neglected to note that oxidized PP exhibits absorbance frequencies (1600 – 1699 cm^{-1} for carbonyl groups and 3409 cm^{-1} for hydroxyl groups) over ranges similar to those of the protein frequencies reported in their study, as described in internal Ethicon documents[43] and published studies.[44] Thus, Thames et al. cannot exclude the possibility that the cracked surface layer was composed of a complex mixture of oxidized PP and protein. Clave et al. noted that "FTIR absorption bands between 1,615 and 1,650 cm^{-1} could be attributed either to carboxylate carbonyl or to residual products of biological origin. Therefore, these results cannot confirm the formation of carboxyl groups in vivo."[45] While Clave et al. did not speculate further on the composition of the cracked layer, it is important to note that their observations did not exclude the possibility of protein or oxidized PP. However, Thames et al. assumed that the cracked surface layer was protein on the basis of FTIR absorption frequencies associated with proteins (amide N-H stretching in the 3,300 cm^{-1} region and amide I carbonyl stretching in the region of 1,600–1,690 cm^{-1}) without noting the existence of overlapping peaks in the FTIR spectra of oxidized PP (1600 – 1699 cm^{-1} for carbonyl groups and 3409 cm^{-1} for hydroxyl groups).

More rigorous methods than those used by Thames et al. are required to correctly identify the composition of the cracked surface layer. Published studies as well as internal Ethicon studies have determined that the cracked surface layer contains oxidized PP. Mr. Burkley analyzed the surface scrapings removed from Prolene sutures explanted from patients using melting point analysis and FTIR, which led him to conclude that the surface contained oxidized PP and protein.[46] His experiments using Soluene to selectively extract tissue from the surface led him to conclude that Soluene could remove the protein adhering to the surface of the fibers but not protein that had penetrated into the pores.[47] Iakovlev et al. used microscopic analysis of axial cross sections of explanted PP mesh fibers to show that surface cracks were predominantly oxidized PP.[48] Imel et al. used EDS[49] and Talley et al. used XPS[50] to identify regions of PP fibers from explanted mesh

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[41] ETH.MESH.12831391

[42] VV Iakovlev, SA Guelcher, R Bendavid. *In vivo* degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *J Appl Biomed Mater Res B: Appl Biomater* 105(2):237-248, 2017.

[43] ETH.MESH.12831391; ETH.MESH.15958452; Memo to Dr. AJ Melveger from Dr. P Moy, Prolene Microcracking, November 5, 1984.

[44] AD Talley, BR Rogers, V Iakovlev, RF Dunn, and SA Guelcher. Oxidation and degradation of polypropylene transvaginal mesh. *J Biomater Sci Polym Ed* 28(5):444-458, 2017.

[45] A Clave, H Yahi, J-C Hammou, S Montanari, P Gounon, H Clave. Polypropylene as a reinforcement in pelvic surgery is not inert: comparative analysis of 100 explants. *Int Urogynecol J* 21:261-270, 2010.

[46] ETH.MESH.12831391; ETH.MESH.15958452

[47] ETH.MESH.15958336

[48] VV Iakovlev, SA Guelcher, R Bendavid. *In vivo* degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *J Biomed Mater Res: Part B Appl Biomater* 105(2):237-248, 2017.

[49] A Imel, T Malmgren, M Dadmun, S. Gido, J Mays. In vivo oxidative degradation of polypropylene pelvic mesh. *Biomaterials* 73:131-141, 2015.

that showed evidence of oxygen on the surface but not nitrogen, which can be explained by oxidation but not protein adsorption. Thames et al. could have used any of these methods to independently characterize the composition of the cracked surface layer rather than simply assume it was protein on the basis of FTIR measurements. Without a more rigorous analysis of the cracked surface layer, it cannot be concluded that it did not include oxidized PP.

3) **The dynamic environment where the Prolene mesh is implanted coupled with the foreign body reaction leads to oxidation, chain scission, reduction in molecular weight, embrittlement, degradation, flaking, pitting, and cracking**;

In an early study, Prolene sutures implanted for 1 – 2 years in a canine thoracoabdominal bypass model showed evidence of transverse cracks and peeling (Mary 1998).[51] Several more recent studies have reported degradation of explanted PP pelvic mesh. In the first study characterizing explanted pelvic mesh, Clavé et al. reported that 42% of the explants showed evidence of chronic inflammation, characterized by an infiltrate of mononuclear cells and FGBCs. SEM analysis revealed that the implants were degraded, and that degradation was observed in meshes that had been implanted for at least 3 months.[52]

In 1985, Ethicon implanted 24 beagles with PROLENE, PVDF, Ethilon, and Novafil sutures subcutaneously in a 10-year study. The study was ended at 7 years due to the unexpected death of one of the dogs at 6 years and 10.5 months. At 7 years, Dr. Lindemann noted that "degradation in Prolene is still increasing" [53] and that three of the seven explanted Prolene sutures showed evidence of surface cracking.[54] Mr. Burkley noted that IR spectra for cracked Prolene specimens "showed possible evidence of slight oxidation (a broadened weak absorbance at about 1650 cm^{-1})."[55] Differences in the crosshead (XH) speed of the testing device can explain the increased elongation at break reported for the 7-year explants, as summarized in Table 1 below:

Table 1. Crosshead speed used to measure tensile properties of the Prolene sutures explanted from dogs.

[50] AD Talley, BR Rogers, V Iakovlev, RF Dunn, and SA Guelcher. Oxidation and degradation of polypropylene transvaginal mesh. *J Biomater Sci Polym Ed* 28(5):444-458, 2017.
[51] C Mary, Y Marois, MW King, G Laroche, Y Douville, L Martin, R Guidoin. Comparison of the In Vivo Behaviour of Polyvinylidene Fluoride and Polypropylene Sutures Used in Vascular Surgery. *ASAIO Journal* 44:199-206, 1998.
[52] A Clave, H Yahi, J-C Hammou, S Montanari, P Gounon, H Clave. Polypropylene as a reinforcement in pelvic surgery is not inert: comparative analysis of 100 explants. *Int Urogynecol J* 21:261-270, 2010.
[53] ETH.MESH.09888187.
[54] ETH.MESH.09888187.
[55] ETH.MESH.09888187.

Reference	Date	Action
ETH.MESH.11336184	5/30/85	XH speed was specified as 5 in / min for all products in the protocol
ETH.MESH.11336184	8/21/87	XH speed was changed to 10 in / min for all products
ETH.MESH.11336071	8/18/88	XH speed was reported as 1 in / min for the 1 yr and 2 yr Prolene explants and 5 in / min for all other 1- and 2-yr explants
ETH.MESH.11336071	9/20/88	XH speed was reported as 10 in /min for all products in the 2-yr interim report
ETH.MESH.05453719	10/19/92	XH speed was reported as 1 in / min for the 7-yr Prolene explants and 5 in / min for all other 7-yr explants

The crosshead speed is a measure of the rate at which the test specimen is strained. As the crosshead speed decreases, the tensile modulus of the polymer being tested decreases while the elongation rate increases.[56] Thus, the crosshead speed is an important experimental parameter, but it is not clear what the crosshead speed was at each of the experimental conditions. As shown in Table 1, the crosshead speed was initially specified as 5 in / min in the original animal protocol. Two years later, the crosshead speed was changed to 10 in / min for all products. However, other documents state that crosshead speeds different from those specified in the protocol were used for 1-, 2-, and 7-year explants, and that these speeds were different for Prolene sutures compared to the other sutures.[57] Therefore, I find the tensile testing of sutures from the dog study to be unreliable due to these discrepancies in the crosshead speeds used for the testing.

In the study that I co-authored with Dr. Iakovlev[58], a layer of degraded PP was observed by optimal microscopy near the surface of the fibers in the explanted mesh (Figure 7). Micro-cracks were present in the degraded PP layer. Degradation and cracking of the polypropylene fibers was observed as early as 18 months for a cohort of 23 explanted PP SUI devices.

Mays et al. also observed degradation of fiber in explanted PP mesh using SEM. Using a combination of SEM and EDS, the authors were able to distinguish between fibers that were clean and those that were coated with biological material. Explanted fibers were observed that showed evidence of severe transverse cracks (Figure 7), which was accompanied by oxidative degradation of the fibers. The authors identified the mechanism of PP degradation as comprising the following steps: infiltration of inflammatory cells that secrete ROS in close proximity to the PP mesh fibers, oxidative degradation of the PP fibers characterized by the appearance of hydroxyl and carbonyl groups in the FTIR spectra, a reduction in molecular weight, embrittlement, cracking, and fragmentation of the PP fibers.

4) PP mesh is known to fray under tension and release particles while being handled

[56] EA Campo. *Selection of Polymeric Material: How to Select Design Properties from Different Standards.* A volume in Plastics Design Library, William Andrew Applied Science Publishers, Norwich, NY 2008.
[57] ETH.MESH.11336071; ETH.MESH.05453719.
[58] VV Iakovlev, SA Guelcher, R Bendavid. In vivo degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *Journal of Applied Biomedical Materials Research B: Applied Biomaterials* 105(2):237-248, 2017.

and implanted. The human body does not stop responding to these particles or to the PP mesh unless the product is removed in its entirety;

As an example of how oxidation of an implanted biomaterial affects its performance, poly(ether urethane)s (PEUs) were used as pacemaker lead insulation due to their improved mechanical properties as compared to silicone rubber. While PEU elastomers were believed to be biocompatible for many years, they are now known to undergo environmental stress cracking due to oxidative degradation of the polyether component and subsequent loss in molecular weight.[59] Adherent macrophages and FBCGs were shown to be responsible for environmental stress cracking. Thus oxidative degradation and environmental stress cracking comprise a vicious cycle in which oxidative degradation drives the embrittlement of the polymer surface and its subsequent cracking, which in turn exposes new surfaces of the material to oxidative degradation. Another study has shown that ROS actively degrades lysine-derived poly(ester urethane)s *in vivo* by an oxidative mechanism.[60] Thus, oxidative degradation of biomaterials *in vivo* in response to ROS secreted by inflammatory cells is well known.

Since the foreign body reaction is present at the biomaterial surface for the lifetime of the implant, the oxidative process is ongoing as long as the implant is present.[61] Considering the ongoing foreign body reaction as well as the known susceptibility of PP to oxidation, the mechanical and physical properties of Ethicon's PP mesh will change after it is implanted.

In addition, the properties of Ethicon's PP mesh have been shown to change under tension and while the mesh is being handled.[62] The medical literature and Ethicon's internal studies have reported that particles are lost or shed from the TVT mesh while it is in the box and while it is being implanted.[63] The foreign body reaction to shed particles will be similar to that for the TVT mesh. The body will not stop responding to any particles that are shed inside the body during implantation until those particles are removed in their entirety.

5) **Ethicon's pelvic meshes are intended to last for the lifetime of the patient, but the presence of antioxidants does not permanently protect the PP against degradation, and thus it is not possible to guarantee that these meshes will perform their intended function after implantation.**

Although PP can never be considered inert, it is stabilized against oxidation by adding antioxidants to the molten polymer, which are intended to act as scavengers that will react

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[59] *Id.*

[60] AE Hafeman, KJ Zienkiewicz, AL Zachman, HJ Sung, LB Nanney, JM Davidson, SA Guelcher. Characterization of degradation mechanisms of biodegradable lysine-derived aliphatic polyurethanes. *Biomaterials* 32(2):419-29, 2011; J Martin, MK Gupta, JM Page, F Yu, JM Davidson, SA Guelcher, CL Duvall. Synthesis of a Porous, Biocompatible Tissue Engineering Scaffold Selectively Degraded by Cell-Generated Reactive Oxygen Species. *Biomaterials* 35(12):3766-76, 2014.

[61] JM Anderson, A Rodriguez, DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol* 20(2): 86–100, 2008.

[62] ETH.MESH.01813975; ETH.MESH.01317515; ETH.MESH.03905472; ETH.MESH.00541379; ETH.MESH.00863391.

[63] *Id.*

with oxidative species.[64] The enduring nature of the foreign body reaction emphasizes the need for antioxidants to be added to biomaterials such that the time to oxidation, degradation, and embrittlement is extended.[65] PP in its pure (i.e., unstabilized) form degrades rapidly *in vivo*, with an induction period of only 108 days[66], and carbonyl groups were detected in unstabilized PP by infrared spectroscopy within 50 – 90 days.[67] Liebert et al. also tested stabilized PP in the hamster subcutaneous implant model. Oxidation of stabilized PP was observed, but the experiment ended at 100 days, at which time induction had not been observed for stabilized PP filaments. Consequently, the eventual *in vivo* induction time for stabilized PP has not been reported.

Stabilization with antioxidants is not permanent, since the purpose of using antioxidants is to react with any oxidative species (such as ROS) to prevent their reaction with PP.[68] These stabilizers are distributed throughout the PP, however, and can only protect the polymer if they are in the proper location and only until they are exhausted. The antioxidant package must be optimized for the intended use to achieve maximum service life of the polymer. Neither the Santonox R nor the dilauralthiodipropionate (DLTDP) antioxidant in the Prolene resin used to manufacture Prolene mesh [69] is designed to protect against the ROS secreted by inflammatory cells *in vivo.* Santonox R is a hindered phenolic antioxidant designed to protect Prolene during high-temperature processing (compounding and extrusion), while DLTDP is designed to protect Prolene from oxidation during long-term storage. Because *in vivo* oxidation and degradation are ongoing in response to the foreign body reaction, the antioxidant will eventually be depleted, resulting in oxidation and degradation of the PP mesh and changes to its properties over time. This cycle of depletion of antioxidants through reaction with ROS followed by the eventual degradation of the surface of the mesh will not stop until all of the mesh is removed, since cracking exposes new surfaces to ROS and the reaction begins anew.[70]

In a manuscript recently accepted for publication, I have reported that TVT, Advantage (Boston Scientific), and Lynx (Boston Scientific) PP meshes, all of which are stabilized with antioxidants, oxidize *in vitro* when incubated in oxidative medium that mimics the reactive oxygen species (ROS) secreted by adherent inflammatory cells. [71] FTIR spectra of

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[64] E. Rene de la Rie. Polymer Stabilizers. A Survey with Reference to Possible Applications in the Conservation Field. Studies in Conservation 33:9-22, 1988.
[65] JM Anderson, A Rodriguez, DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol* 20(2): 86–100, 2008.
[66] Liebert et al. Subcutaneous implants of PP filaments. *JBMR* 10:939-51, 1976.
[67] *Id*.
[68] *Id*.
[69] ETH.MESH.02268620
[70] JM Anderson, A Rodriguez, DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol* 20(2): 86–100, 2008.
[71] QH Zhao, AK McNally, KR Rubin, M Renier, Y Wu, V Rose-Caprara, JM Anderson, A Hiltner, P Urbanski, K Stokes. Human plasma macroglobulin promotes in vitro oxidative stress cracking of Pellethane 2363-80A: In vivo and in vitro correlations. *J Biomed Mater Res* 27: 379-389, 1993. AE Hafeman, KJ Zienkiewicz, AL Zachman, HJ Sung, LB Nanney, JM Davidson, SA Guelcher. Characterization of degradation mechanisms of biodegradable lysine-derived aliphatic polyurethanes. *Biomaterials* 32(2):419-29, 2011. JL Martin, MK Gupta, JM Page, F Yu, JM Davidson, SA Guelcher, CL Duvall. Synthesis of a Porous, Biocompatible Tissue Engineering Scaffold Selectively Degraded by Cell-Generated Reactive Oxygen Species. *Biomaterials* 35(12):3766-76, 2014. MAP McEnery, S Lu, MK Gupta, KJ Zienkiewicz, JC Wenke, K Kalpakci, D Shimko, CL Duvall, SA Guelcher. Resorbable Poly(thioketal urethane)/Ceramic Composite Bone Cements with Bone-Like Strength. *RSC Advances* 6:109414 - 109424, 2016. JR Martin, CE

PP incubated in oxidative medium for 5 weeks revealed evidence of carbonyl and hydroxyl bonds as predicted by the oxidation mechanism. These findings show that antioxidants cannot stabilize PP mesh indefinitely.

6) The effects of oxidation on the stability of Prolene were known to Ethicon prior to launching its SUI and POP devices, but the company did not consider the risks associated with polypropylene oxidation on the stability of Prolene mesh, to the detriment of patients implanted with the devices.

Ethicon first reported evidence of Prolene oxidation and degradation in internal documents from the 1980s. These documents report evidence of chronic inflammation, oxidation, and degradation (micro-cracking) of Prolene sutures similar to that published in the scientific literature described above. Several relevant studies are reviewed in greater detail below.

In 1981, the depth of surface cracks was measured for explanted cardiovascular and ophthalmic Prolene sutures.[72] The crack depth varied from 0.5 – 4.5 microns. Another memo in 1983 reported cracking of explanted Prolene sutures.[73] One of the explanted sutures showed only 54% of its original strength. The memo noted that the histological evaluation of explanted sutures was consistent with previous studies, characterized by a foreign body reaction and a "degraded acellular infiltrate." This document also refers to a Prolene Microcrack Committee. Thus, Ethicon was sufficiently aware of Prolene surface cracking to form a committee to investigate the mechanism of cracking.

Two memos written in 1984 investigated the cause of microcracking of explanted PP sutures from both ophthalmic and cardiovascular applications[74]. Sutures that were in the body for more than two years exhibited surface or severe transverse cracks. The thickness of the crack layer ranged from 2 – 5 microns thick. Dr. Peter Moy recognized in a November 5, 1984 report that "oxidative degradation is another mechanism through which transverse cracks may be produced on oriented fibers."[75] In an attempt to reproduce the observed cracking *in vitro*, Prolene sutures were incubated in aqueous 30% hydrogen peroxide for up to 1 year. Despite the fact that transverse cracks were not observed, infrared spectroscopy revealed evidence of oxidation products, which prompted Dr. Moy to note that "the possibility of a highly specific *in vivo* oxidation process remains." These findings are consistent with the foreign body reaction, which produces ROS stronger than hydrogen peroxide.[76] If treatment with 30% hydrogen peroxide caused oxidation of the PP suture (as reported by Dr. Moy), then ROS secreted by adherent macrophages would also be expected to cause oxidation. Dr. Moy also cited thermal stability and electron microdiffraction data supporting his hypothesis that at least a portion of the cracked layer contained protein. He recommended that an additional study was necessary to test this hypothesis by performing TEM analysis of known oxidized Prolene samples. Another memo dated November 13, 1984, reported that Prolene microcracks were evaluated by

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Nelson, MK Gupta, F Yu, KM Hocking, JM Davidson, SA Guelcher, CL Duvall. Local delivery of PHD2 siRNA from ROS-degradable scaffolds to promote diabetic wound healing. *Adv Healthc Mater* 5(21):2751-2757, 2016.

[72] ETH.MESH.12831405.

[73] ETH.MESH.15955438-15955473.

[74] ETH.MESH.15958452, ETH.MESH.15406978, ETH.MESH.15958470

[75] ETH.MESH.1595843

[76] QH Zhao, AK McNally, KR Rubin, M Renier, Y Wu, V Rose-Caprara, JM Anderson, A Hiltner, P Urbanski, K Stokes. Human plasma macroglobulin promotes in vitro oxidative stress cracking of Pellethane 2363-80A: In vivo and in vitro correlations. *J Biomed Mater Res* 27: 379-389, 1993.

Attenuated Total Reflectance (ATR) and FTIR.[77] These studies found that the cracked Prolene surface is a composite of oxidized polypropylene and adsorbed protein. Surface protein was removed with Soluene treatment, but adsorbed protein remained in the microcracks. Thus, the November 13, 1984 memo by Dan Burkley concludes that the cracked layer contained both oxidized Prolene as well as protein.

In 1985, a series of experiments was proposed, including microscopic FTIR, TEM, and histology, to determine the clinical functionality of cracked sutures, the cracking mechanism, and effects of antioxidant concentration.[78] Dr. Moy further noted that laboratory experiments had not yet replicated the cracking observed in explants, and proposed a systematic evaluation of explanted Prolene sutures.

In 1987, Professor Guidoin provided Ethicon with his explanted sutures, which had been cleaned using a bleach solution as explained in Mr. Burkley's laboratory notebook.[79] SEM images of sutures explanted after 8 years revealed evidence of severe cracking. Another cohort of explanted sutures was scraped with a needle and the scrapings tested by calorimetry and FTIR. The waxy scrapings showed a melting point of 147 – 156^{o}C, which is comparable to that of degraded Prolene. Non-degraded Prolene melts over the range 155 – 165^{o}C. Scrapings were also melted on a KBr window to obtain FTIR spectra, which showed peaks associated with β-keto esters known to be formed during PP oxidation. Mr. Burkley noted in his notebook and memo that "no protein species or peptide bonds were suggested." A memo reporting on a follow-up meeting confirmed the findings that no protein was found on the surface and that Prolene degradation occurred on the surface of the fibers.[80] Several follow-up studies were proposed, including investigating the relationship between antioxidant concentration and polypropylene degradation and cracking. However, to my knowledge these studies were not performed.

In 1991, a 91-day rat subcutaneous implantation study was performed to assess the tissue reaction for several PP-based surgical meshes, including the Prolene mesh used in the SUI and POP devices.[81] All meshes, including Prolene and Prolene Soft, showed evidence of chronic inflammation at 7 and 91 days. Drs. Barbolt and Hutchinson concluded that all meshes showed evidence of a mild inflammatory reaction and infiltration of connective tissue. Furthermore, images of histological sections revealed evidence of adherent macrophages on the surface of the Prolene fibers.

[77] ETH.MESH.15958336
[78] ETH.MESH.15958445
[79] ETH.MESH.00000367, ETH.MESH.12831391
[80] ETH.MESH.12831407
[81] ETH.MESH. 02319001, ETH.MESH.01425079

As noted above, Ethicon researchers sought to replicate the surface cracking of Prolene sutures in an *in vitro* experiment. In the 1990s, the effects of the foreign body reaction on biomedical implants were first elucidated. All implantable medical devices are susceptible to the dynamic nature of the environment in which they are implanted. Environmental stress cracking of implanted biomaterials is controlled by three factors: (1) residual stress in the biomaterial, (2) a source of chemical degradation in the body, and (3) the chemical structure of the biomaterial.[82] Poly(ether urethane)s used as pacemaker lead insulation are an example of how oxidation of an implanted biomaterial can lead to Environmental Stress Cracking (ESC) and device failure. While poly(ether urethane) elastomers were believed to be biocompatible for many years, they are now known to undergo ESC due to oxidative degradation of the polyether component and subsequent loss in molecular weight.[83] As shown in Figure 9, adherent macrophages and FBCGs were responsible for environmental stress cracking of poly(ether urethane)s *in vivo*.[84] A later study found that *in vivo* stress cracking of this poly(ether urethane) was reproduced *in vitro* by treating pre-stressed polymer specimens with an oxidative medium (10% hydrogen peroxide with 0.10 M cobalt chloride).[85] The cobalt chloride catalyzes the decomposition of the hydrogen peroxide to form hydroxyl radicals, a form of ROS that attacks the polymer. Under these conditions simulating the isolated microenvironment between the surface of the biomaterial and the cell, *in vitro* stress cracking was similar in appearance to that observed *in vivo*. Furthermore, infrared spectroscopy showed that ROS participated in the oxidative degradation process.[86] Thus, oxidative degradation and environmental stress cracking have a synergistic effect on the failure of poly(ether urethane) catheter lead insulation, by which oxidative degradation drives the embrittlement of the polymer surface and its subsequent cracking, which in turn exposes new surfaces of the material to oxidative degradation and

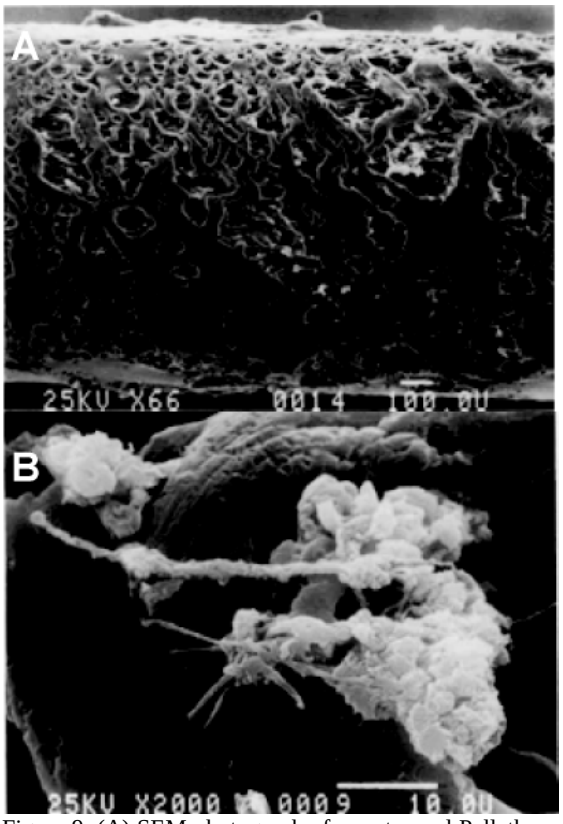

Figure 9. (A) SEM photograph of pre-stressed Pellethane 80A specimen implanted for 5 weeks. The specimen had severe cracking. Original magnification x66. (B) SEM photograph (at higher magnification) of pre-stressed Pellethane 80A specimen implanted for 5 weeks. Cellular adhesion was present. Original magnification x2000. From Zhao et al. JBMR 24:621, 1990.

[82] JM Anderson et al. Cellular interactions with biomaterials: in vivo cracking of pre-stressed Pellethane 2363-80A. *JBMR* 24: 621-37, 1990.
[83] *Id*.
[84] JM Anderson et al. Cellular interactions with biomaterials: in vivo cracking of pre-stressed Pellethane 2363-80A. *JBMR* 24: 621-37, 1990.
[85] QH Zhao, AK McNally, KR Rubin, M Renier, Y Wu, V Rose-Caprara, JM Anderson, A Hiltner, P Urbanski, K Stokes. Human plasma macroglobulin promotes in vitro oxidative stress cracking of Pellethane 2363-80A: In vivo and in vitro correlations. *J Biomed Mater Res* 27: 379-389, 1993.
[86] MJ Wiggins, B Wilkoff, JM Anderson, A Hiltner. Biodegradation of polyether polyurethane inner insulation in bipolar pacemaker leads. *J Biomed Mater Res* 58(3):302–7, 2001.

ultimately clinical device failure.[87] Similar to poly(ether urethane)s, PP is susceptible to oxidation, which results in chain scission, loss of ductility (e.g., embrittlement),[88] and degradation, such as pitting, peeling, and cracking[89]. Embrittlement occurs at a very low conversion in the chain scission process, and surface embrittlement of the PP fibers leads to crack initiation. Mechanical stress on the fibers will in turn enhance stress cracking and expose new PP surface to the oxidative environment. I have published two papers in the scientific journal *Biomaterials*, one in 2011 and one in 2014, using the same 20% H_2O_2 /0.1 M cobalt chloride system to measure the oxidative degradation rate of poly(ester urethane) and poly(thioketal urethane) scaffolds. Thus, this *in vitro* oxidative degradation test is well established in the scientific literature, and was available to Ethicon at the time it developed the SUI and POP devices. However, to my knowledge, this test was never done.

Ethicon has also been made aware of the specific risks inherent to using PP in an implantable medical device through the Material Safety Data Sheet (MSDS), which stated that PP is incompatible with strong oxidizers.[90] As explained above, implanted mesh is exposed to reactive oxygen species, which are strong oxidizers, as a result of the foreign body reaction.

The report from Mesh Repair of Uterovaginal Prolapse meeting in May 1997 noted that an ideal mesh would have lower density compared to that of the TVT to minimize the foreign body reaction.[91] Similar concerns were noted in a discussion document for the design of new mesh for prolapse repair, in which it was noted that the mesh used in the TVT is not the ideal material for anterior prolapse, and that the amount of foreign body should be minimized to reduce the risk of complications.[92]

The hernia literature also provides evidence that the foreign body reaction alters polypropylene *in vivo*. In a study evaluating non-degradable meshes explanted from 17 patients that had surgery for repair of abdominal wall defects, a foreign body reaction characterized by granulation tissue and inflammatory cells 3 – 24 months post-implantation was seen.[93] The PP meshes from this study showed more inflammatory cells and fibroblasts near the mesh interface when compared to PTFE and polyester.

Despite internal and published studies to the contrary, Ethicon documents further indicate that their sales force was instructed to "[r]eassure [surgeons] that PROLENE is proven to be inert and there are hundreds of papers going back 25 years to reinforce this point."[94] However, Daniel F. Burkley, a Principal Scientist at Ethicon, testified that in his 34 years at the company, he was only familiar with one study that was conducted regarding the changes that occurred due to oxidative degradation of explanted polypropylene suture or

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[87] JM Anderson, A Rodriguez, and DT Chang. Foreign Body Reaction to Biomaterials. *Semin Immunol* 20(2):86–100, 2008.
[88] Fayolle et al. Initial steps and embrittlement in the thermal oxidation of stabilized polypropylene films. *Polym Degrad Stability* 75:123-9, 2002.
[89] VV Iakovlev, ET Carey, J Steege. Pathology of Explanted Transvaginal Meshes. *Int. J. Medical, Health, Pharmaceutical and Biomedical Eng*. 8(9):510-513, 2014.
[90] ETH.MESH.05439518
[91] ETH.MESH.12006257
[92] ETH.MESH.12009027
[93] U Klinge, B Klosterhalfen, M. Muller, V Schumpelick. Foreign Body Reaction to Meshes Used for the Repair of Abdominal Wall Hernias. *Eur J Surg* 165:665–673, 1999.
[94] ETH.MESH. 00865322

mesh.[95] Mr. Burkley also testified that this study showed that changes due to oxidation were still progressing after seven years of implantation.[96]

7) PP mesh is not inert and its properties change after implantation, which can lead to adverse events in an implantee; using heavy-weight mesh directly correlates to more PP being exposed to the foreign body reaction and greater changes after implantation, which increases the risk of complications.

The literature has confirmed that the properties of PP mesh change after implantation, causing adverse events like, pain, scarring and inflammation. In addition, Ethicon employees and consultants, both before and after the TVT was launched, have noted that heavy-weight meshes like the TVT comprise significantly more polypropylene than sutures or light-weight meshes, and therefore the foreign body reaction and resulting changes on the surface of the TVT device will be much greater than that for a lightweight mesh or a non-load bearing suture.[97] These findings are supported by the conclusions drawn by external consultants and Ethicon employees, as well as the available scientific literature reporting PP oxidation in response to cell-secreted ROS and complications associated with the mesh used in the TVT.[98]

More recently, Wood et al. published a comparison of three different explanted synthetic meshes (polypropylene, expanded polytetrafluoroethylene (ePTFE), and polyethylene terephthalate (PET)) from a single patient who had undergone three recurrent ventral hernia repairs.[99] Implantation times for the meshes were 3 years for the PP and PET meshes and 2 years for the ePTFE mesh. SEM images of explanted PP mesh "showed significant surface cracking" while the PET and ePTFE meshes did not. FTIR analysis also confirmed PP degradation from "free radical formation and oxidation of the polypropylene mesh while *in vivo."*

The Wood study supports the conclusions published by Clavé et al., which examined explanted pelvic meshes for degradation. Clavé reported that 42% of the explants showed evidence of chronic inflammation, characterized by an infiltrate of mononuclear cells and FGBCs. SEM analysis revealed that the implants were degraded, and that degradation was observed in meshes that had been implanted for at least 3 months.[100]

The findings of the Clavé study findings reinforced work done by Costello et al., who reported PP mesh oxidation and embrittlement as being a cause of mesh degradation and

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[95] Burkley Deposition 05/23/2013 P.312:23-313:24

[96] Burkely Deposition 05/23/2013 P.315:8-13

[97] Are Meshes With Lightweight Construction Strong Enough?; Jorge L. Holste*; ETHICON GmbH, R&D Europe, D-22841*, Norderstedt, Germany; J. Otto, E. Kaldenhoff, R. Kirschner-Hermanns, T. Muhl, U. Klinge. W.S. Cobb, K.W. Kercher, and B.T. Heniford.The Argument for Lightweight Polypropylene Mesh in Hernia Repair. *Surg Innov*. 12(1):63-9, 2005.

[98] ETH.MESH.05479411, ETH.MESH.07192929, ETH.MESH.07192412.

[99] AJ Wood, et al. Materials Characterization and Histological Analysis of Explanted Polypropylene, PTFE, and PET hernia meshes from an Individual Patient. *J Mater Sci Mater Med* 24(4): 1113-1122, 2013.

[100] A Clave, H Yahi, J-C Hammou, S Montanari, P Gounon, H Clave Polypropylene as a reinforcement in pelvic surgery is not inert: comparative analysis of 100 explants. *Int Urogynecol J* 21:261-270, 2010.

complications *in vivo*.[101] Costello derived his conclusions from comparisons made between pristine and explanted samples via molecular weight, SEM imaging, and compliance testing. Those authors reported that all three of these methods confirmed that PP mesh had degraded *in vivo*, most likely by oxidation.[102]

Another study investigated 14 explanted hernia mesh samples observed by SEM that 85% of the samples showed evidence of cracking, fissures, and peeling.[103] After host tissue was removed, the mesh samples remained folded and contracted, evidencing that mesh samples were permanently changed after implantation.

In a 2015 study I co-authored with Dr. Vladimir Iakovlev analyzing 164 explanted PP pelvic meshes, we reported the presence of adherent inflammatory cells expressing the oxidative enzyme myeloperoxidase, degradation of polypropylene, and micro-cracking near the surface of the polypropylene fibers. Degradation of explanted meshes was observed as early as 18 months.[104] Similar findings were reported by Mays et al., who observed oxidative degradation and transverse cracking of explanted PP pelvic mesh.[105]

Most importantly, these studies linked complaints of chronic pain and sclerosis to the foreign body reaction to implanted PP mesh and the consequent degradation and micro-cracking near the surface of PP fibers. These principles also apply to PP particles shed from the mesh during implantation, which is consistent with the testimony of Ethicon medical director Piet Hinoul that when particle loss occurs during implantation, the released particles result in inflammation that can cause pain.[106]

Large animal models, such as sheep, enable evaluation of PP mesh at longer time points and under conditions more representative of the clinical environment for SUI and POP repair.[107] A pilot study evaluated Prolene mesh implanted vaginally in sheep at 6 and 12 weeks.[108] The incidence of vaginal erosion was observed to be 33%. Macrophages and foreign body giant cells were also observed at 12 weeks. Two more recent studies have investigated differences between PP meshes implanted vaginally and abdominally using a sheep model.[109] PP mesh implanted vaginally showed more contraction and exposures,

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[101] CR Costello, SL Bachman, SA Grant, DS Cleveland, TS Loy, BJ Ramshaw. Characterization of heavyweight and lightweight polypropylene prosthetic mesh explants from a single patient. *Surg Innov*. 14:168–176, 2007; CR Costello, SL Bachman, SA Grant. Materials characterization of explanted polypropylene hernia meshes. *J Biomed Mater Res Part B: Appl Biomater* 83B:44-49, 2007.

[102] *Id.*

[103] *Id*.

[104] VV Iakovlev, SA Guelcher, R Bendavid. In vivo degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *J Appl Biomed Mater Res B: Appl Biomater* 105(2):237-248, 2017.

[105] A Imel, T Malmgren, M Dadmun, S. Gido, J Mays. In vivo oxidative degradation of polypropylene pelvic mesh. *Biomaterials* 73:131-141, 2015.

[106] Trial Testimony of Piet Hinoul, Batiste v. Ethicon, page 26-28

[107] A Feola, M Endo, I Urbankova, J Vlacil, T Deprest, S Bettin, B Klosterhalfen, J Deprest. Host reaction to vaginally inserted collagen containing polypropylene implants in sheep. *Am J Obstet Gynecol* 212:474.e1-8, 2015.

[108] R de Tayrac, A Alves, M Thérin M. Collagen-coated vs noncoated low-weight polypropylene meshes in a sheep model for vaginal surgery. A pilot study. *Int Urogynecol J Pelvic Floor Dysfunct*. 18(5):513-20, 2007.

[109] S Manodoro, M Endo, P Uvin, M Albersen, J Vláčil, A Engels, B Schmidt, D De Ridder, A Feola, J Deprest. Graft-related complications and biaxial tensiometry following experimental

which are both mesh-related complications, than mesh implanted abdominally.[110] The authors further noted that the 15% incidence of vaginal exposures in all animals was comparable to that observed clinically, and found that mesh-related complications can be induced by vaginal mesh implantation. Contraction and folding, which have also been associated clinically with pain,[111] were also observed to be higher for vaginally implanted mesh compared to that implanted abdominally. In a follow-up study, the same authors investigated the effects of a collagen coating on mesh complications and made similar findings.[112] Vaginal exposures were observed in 33%, while no abdominal exposures were observed. Macrophages and foreign body giant cells were observed at 60 and 180 days in both vaginal and abdominal meshes. These findings led the authors to conclude that the sheep is an effective model to study complications of vaginal mesh. They further noted that the differential wound healing response and mechanical forces between the vaginal and abdominal wall environments may be responsible for the differences in mesh-related complications between the two implantation sites. Ethicon could have performed a similar sheep study at any time before or after the launch of its any of its mesh products to investigate the incidence of similar mesh-related complications. However, to my knowledge these studies have not been done.

Ethicon documents indicate that the company was aware of the Costello article in 2007, but never considered the effect of PP oxidation during these meshes design or product lifecycle. An Ethicon Medical Affairs employee, Tom Divilio, M.D., indicated that the Costello authors were "challenging our perception of polypropylene as an 'inert' material after implantation." He went on to note that "I think it's important that we understand what they are seeing as this group has a well-funded lab that will be looking at explanted mesh in great volume over the next couple of years and our current concepts are going to be challenged. Would appreciate it if we could think of some study designs that would confirm or refute their assumptions."[113] In 2012, Ethicon responded to a request by a British regulatory agency to explain how the 2010 publication by Clave et al impacts the performance of their products.[114] In this document, Ethicon noted "[we] are not aware of any findings that would impact the clinical performance of polypropylene monofilament"[115], and that "[p]olymers may be subject to surface degradation by these

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vaginal implantation of flat mesh of variable dimensions. *BJOG* 120(2):244-50, 2013.; A Feola, M Endo, I Urbankova, J Vlacil, T Deprest, S Bettin, B Klosterhalfen, J Deprest. Host reaction to vaginally inserted collagen containing polypropylene implants in sheep. *Am J Obstet Gynecol* 212:474.e1-8, 2015.

[110] S Manodoro, M Endo, P Uvin, M Albersen, J Vláčil, A Engels, B Schmidt, D De Ridder, A Feola, J Deprest. Graft-related complications and biaxial tensiometry following experimental vaginal implantation of flat mesh of variable dimensions. *BJOG* 120(2):244-50, 2013.

[111] BT Haylen, RM Freeman, SE Swift, M Cosson, GW Davila, J Deprest et al. An International Urogynecological Association (IUGA)/ International Continence Society (ICS) joint terminology and classification of the complications related directly to the insertion of prostheses (meshes, implants, tapes) and grafts in female pelvic floor surgery. *Neurourol Urodyn* 30:2–12, 2011.

[112] Haylen BT, Freeman RM, Swift SE, Cosson M, Davila GW, Deprest J, et al. An International Urogynecological Association (IUGA)/ International Continence Society (ICS) joint terminology and classification of the complications related directly to the insertion of prostheses (meshes, implants, tapes) and grafts in female pelvic floor surgery. Neurourol Urodyn 30:2–12, 2011; A Feola, M Endo, I Urbankova, J Vlacil, T Deprest, S Bettin, B Klosterhalfen, J Deprest. Host reaction to vaginally inserted collagen containing polypropylene implants in sheep. *Am J Obstet Gynecol* 212:474.e1-8, 2015.

[113] ETH.MESH. 05588123

[114] ETH.MESH. 07226481

[115] Id

reactive species, the impact of which has not been clinically assessed."[116]

In summary, Ethicon scientists reported evidence of chronic inflammation, oxidation, and degradation (micro-cracking) of Prolene in preclinical studies and in human explants. These observations are consistent with the known susceptibility of polypropylene to oxidation outside the body, the known effects of the foreign body reaction on implanted biomaterials, and published studies on explanted PP mesh.[117] Despite the fact that Ethicon scientists recommended additional testing to confirm or exclude the oxidation mechanism, I have found no evidence that these tests (which were available to Ethicon during development of the SUI and POP devices) were performed. Consequently, the risks inherent to Prolene oxidation and degradation are detrimental to all of those who have been implanted with the SUI and POP devices.

8) Using autologous fascia lata, allograft, sutures (including polypropylene sutures), or polyvinylidene fluoride (PVDF) mesh, does not present with the same chronic complications associated with the material properties of Ethicon's PP mesh. All of these alternative materials, including using a less dense version of its PP mesh, were available when Ethicon's SUI and POP meshes were first commercialized.

Implantable sutures, including PP sutures, have been used in procedures such as the Burch retropubic urethropexy, autologous and allograft biologic slings, and needle suspension procedures to treat SUI.[118] As described above, the foreign body reaction is less persistent for sutures than for polypropylene mesh. In an early study investigating the effects of the foreign body reaction on Prolene sutures implanted in dogs, sutures were surrounded by fibroblasts, collagen, and a few macrophages at 1 – 3 months.[119] From 3 months to 2 years, Prolene sutures were encapsulated in collagen with minimal adherent inflammatory cells.[120] In a later study characterizing the foreign body reaction associated with PP sutures and mesh in a rat abdominal wall model, PP mesh samples showed more adherent inflammatory cells than PP sutures.[121] Recent studies investigating PP mesh explanted from human patients[122] have reported adherent inflammatory cells near the surface of the PP

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[116] Id

[117] VV Iakovlev*, SA Guelcher, R Bendavid. In vivo degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *J Appl Biomater Res: Part B Appl Biomater* 105(2):237-248, 2017.

[118] ETH.MESH.00141933; AP Cameron, AM Haraway. The treatment of female stress urinary incontinence: an evidenced-based review. Open Access Journal of Urology 3:109-120, 2011; EC Trabuco, CJ Klingele, RE Blandon, JA Occhino, AL Weaver, ME McGree, MA Lemens, JB Gebhart. Burch Retropubic Urethropexy Compared With Midurethral Sling With Concurrent Sacrocolpopexy: A Randomized Controlled Trial. Obstet Gynecol. 2016 Oct;128(4):828-35

[119] C Mary, Y Marois, MW King, G Laroche, Y Douville, L Martin, R Guidoin. Comparison of the In Vivo Behaviour of Polyvinylidene Fluoride and Polypropylene Sutures Used in Vascular Surgery. *ASAIO Journal* 44:199-206, 1998. ML Konstantinovic, E Pille, M Malinowska, E Verbeken, D De Ridder, J Deprest. Tensile strength and host reponse towards different polypropylene implant materials used for augmentation of fascial repair in a rat model. *Int Urogynecol J* 18:619-26, 2007.

[120] Id.

[121] ML Konstantinovic, E Pille, M Malinowska, E Verbeken, D De Ridder, J Deprest. Tensile strength and host reponse towards different PP implant materials used for augmentation of fascial repair in a rat model. Deprest et al. *Int Urogynecol J* 18:619-26, 2007.

[122] VV Iakovlev, SA Guelcher, R Bendavid. *In vivo* degradation of polypropylene: microscopic analysis of meshes explanted from 130 patients. *J Appl Biomater Res: Part B Appl Biomater*, 2015 Aug 28 doi: 10.1002/jbm.b.33502; A Clavé, H Yahi. J-C Hammou, S Montanari, P Gounon, H

fibers at periods of time from 3 months to multiple years. These studies show that the foreign body reaction in response to mesh implantation continues until the mesh is explanted and is dose-dependent (*i.e.*, more PP mesh both in density and amount promotes a more persistent foreign body reaction). Thus, since the foreign body reaction associated with implantable PP sutures is less persistent compared to PP mesh, the use of sutures is preferred from a biomaterials perspective. Furthermore, there is the additional benefit that the suture procedures do not present the risk of mesh-related complications.

Biologic grafts are derived from natural tissue that has been processed to remove cells and antigens that trigger an immune response while preserving the extracellular matrix that stimulates ingrowth of cells and tissue remodeling.[123] They are preferred from a biomaterials perspective because they promote a regenerative versus a scarring response. Biologic grafts can be classified into three general categories: (1) autologous fascia lata (autograft), (2) cadaveric fascia or dermal tissue (allograft), and (3) bovine or porcine tissue (xenograft). [124] In contrast to synthetic grafts, biologic grafts are designed to promote vascularization and tissue remodeling, not scarring.[125] Biologic grafts are resorbed and replaced by new tissue, thereby eliminating the types of complications associated with PP mesh. In contrast, the foreign body reaction associated with implantation of PP mesh persists for years and is not resolved until the mesh is removed, resulting in oxidation, embrittlement, and degradation. Thus, autografts and allografts eliminate the types of complications associated with the degradation of PP products in the pelvis.

Allografts are medical products that have been prepared from human cadaveric fascia [126] and human dermis. [127] Allografts include DuraDerm (Bard, decellularized human dermis,) FasLata (Bard, cadaveric fascia lata), and Repliform (Boston Scientific, decellularized human cadaveric dermis). They are indicated for repair or replacement of damaged or inadequate integumental tissue, such as in the treatment of urinary incontinence, and for pelvic floor reinforcement or other conditions resulting from inadequate or damaged integumental tissue. Dermal allografts such as Repliform are processed under unique conditions to maintain the structure of the collagen and stimulate fibroblast remodeling of the extracellular matrix, resulting in cellular infiltration, vascularization, and new tissue ingrowth to achieve regenerative repair with reduced scarring and risk of exposure. [128] In a prospective series of 253 patients with SUI treated with a transvaginal sling using a Repliform cadaveric human dermal allograft and a bone anchor fixation kit, 234 of 253 patients were followed up at an average of 18 months.[129] 78% of the patients were cured or

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Clavé. PP as a reinforcement in pelvic surgery is not inert: comparative analysis of 100 explants. *Int Urogynecol J* 21:261-270, 2010; A Imel, T Malmgren, M Dadmun, S. Gido, J Mays. In vivo oxidative degradation of polypropylene pelvic mesh. *Biomaterials* 73:131-141, 2015; AL Nolfi, BN Brown, R Liang, SL Palcsey, MJ Bonidie, SD Abramowitch, PA Moalli. Host response to synthetic mesh in women with mesh complications. *Am J Obstet Gynecol* 215:206.e1-8, 2016.

[123] ETH.MESH.00141933

[124] ETH.MESH.04941016

[125] ETH.MESH.04941016

[126] SL Brown, FE Govier. Cadaveric versus autologous fascia lata for the pubovaginal sling: surgical outcome and patient satisfaction. *J Urology* 164, 1633—1637, 2000.

[127] S Crivellaro, JJ Smith, E. Kocjancic, JF Bresette. Transvaginal sling using acellular human dermal allograft: safety and efficacy in 253 patients. *J Urology* 172, 1374–1378, 2004.

[128] ETH.MESH.00141933

[129] S Crivellaro, JJ Smith, E. Kocjancic, JF Bresette. Transvaginal sling using acellular human dermal allograft: safety and efficacy in 253 patients. *J Urology* 172, 1374–1378, 2004

improved according to patient questionnaires. Most significantly, there were no cases of vaginal or urethral erosion.[130]

Polyvinylidene fluoride (PVDF) is a synthetic polymer manufactured by polymerization of vinylidene difluoride. As shown in Figure 10, PVDF is one of the least readily oxidized polymers, while PP is one of the most.[131] PVDF sutures are used extensively in orthopaedic and cardiovascular surgery.[132] In 1988, Mary et al. compared PROLENE to PVDF sutures in a canine thoracoabdominal bypass model for 10 periods of implantation ranging from 4 hours to 2 years.[133] PROLENE sutures explanted after 1 or 2 years implantation time showed evidence of surface cracking by SEM. In contrast, PVDF sutures explanted after 1 or 2 years did not show evidence of surface cracking when analyzed by SEM. These findings led the authors to conclude that PVDF "may be more biostable than polypropylene in the long term." In another long-term study, PVDF sutures preserved 92.5% of their initial strength after 9 years of implantation compared to 54.4% for PP sutures due to oxidation of the PP.[134]

In 1985, Ethicon implanted 24 beagles with PROLENE, PVDF, Ethilon, and Novafil sutures implanted subcutaneously in a 10-year study. Sutures were explanted at 5 or 7 years (the study was ended prematurely due to the unexpected death of one of the dogs at 6 years and 10.5 months). At 5 years, surface cracking was observed by SEM for 2 of the 5 PROLENE sutures, while surface cracking was not observed for any of the PVDF sutures. At 7 years, PROLENE sutures explanted from 3 of the 7 sites showed surface cracking by SEM, while only 1 of the 6 PVDF sutures showed evidence of surface cracking. The authors noted that only PDVF and Novafil sutures showed only marginal surface changes. The authors concluded that "degradation in PROLENE is still increasing and PVDF, even though a few cracks were found, is still by far the most surface resistant in-house made suture in terms of cracking."[135] These findings are consistent with those from the Mary et al. study[136] and the resistance of PVDF to oxidative degradation.[137]

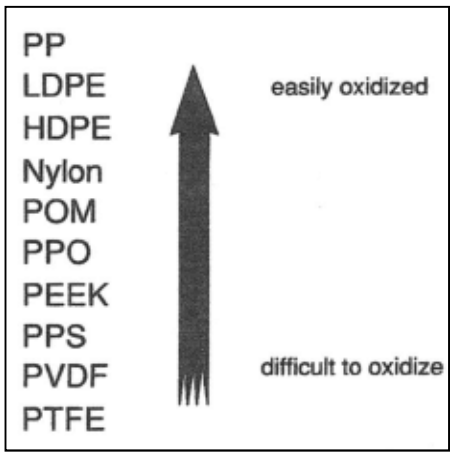

Figure 10. Tendency of various polymers to undergo oxidation. Reproduced from Compositional and Failure Analysis of Polymers, 2000, p. 398, 426.

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[130] SL Brown, FE Govier. Cadaveric versus autologous fascia lata for the pubovaginal sling: surgical outcome and patient satisfaction. *J Urology* 164, 1633—1637, 2000. BJ Flynn, WT Yap. Pubovaginal sling using allograft fascia lata versus autograft fascia for all types of stress urinary incontinence: 2-year minimum followup. *J Urology* 167, 608–612, 2002.

[131] Compositional and Failure Analysis of Polymers, 2000, p. 398, 426.

[132] K Junge, M Binnebösel, KT von Trotha, R Rosch, U Klinge, UP Neumann, PL Jansen. Mesh biocompatibility: effects of cellular inflammation and tissue remodeling. *Langenbecks Arch Surg* 2011, DOI 10.1007/s00423-011-0780-0.

[133] C Mary, Y Marois, MW King, G Laroche, Y Douville, L Martin, R Guidoin. Comparison of the In Vivo Behaviour of Polyvinylidene Fluoride and polypropylene Sutures Used in Vascular Surgery. *ASAIO Journal* 44:199-206, 1998.

[134] G Laroche, Y Marois, E Schwarz, et al. Polyvinylidene fluoride monofilament sutures: can they be used safely for long-term anastomoses in the thoracic aorta? *Artif Organs* 19 (11):1190–9, 1995.

[135] ETH.MESH.05453719; ETH.MESH.11336474

[136] C Mary, Y Marois, MW King, G Laroche, Y Douville, L Martin, R Guidoin. Comparison of

In an Ethicon-funded study, two PVDF hernia meshes were compared to PROLENE to assess differences in function tissue response. Mesh was implanted in a rat abdominal wall inlay model for 3, 14, 21, 42 and 90 days.[138] PVDF meshes showed significantly decreased inflammatory and fibrous tissue reactions compared to PROLENE mesh. After day 3, the PVDF meshes showed a significantly lower volume fraction of inflammatory cells compared to PROLENE mesh. PROLENE mesh showed an increased volume fraction of granulocytes, macrophages, and fibroblasts compared to PVDF meshes. In contrast, PVDF meshes showed a higher volume fraction of foreign body giant cells, which are indicative of a primarily chronic response. The authors further noted that PVDF meshes showed similar cellular responses despite their differences in weight. The moderate foreign body reaction observed for the PVDF meshes showed fewer granulocytes, macrophages, and fibroblasts, and a greater number of foreign body giant cells. Based on these findings, the authors concluded that both PVDF meshes induced significantly lower inflammation and fibrosis compared to PP mesh, and that PVDF is a possible alternative material to PP.

Internal Ethicon documents reveal that Ethicon employees and consultants were aware of the improved biostability of PVDF compared to PP. In 2007, Dr. Kersin Spychaj, an Ethicon employee, wrote a memo on mesh shrinkage based on a literature review.[139] Dr. Spychaj noted that PP induces a rapid and acute inflammatory response, and concluded that the ideal mesh induces a "mild but not excessive FBR." Also in a 2007 email, Dr. Dieter Engel, an Ethicon employee, stated that Ethicon will move to Pronova (a copolymer of PVDF and hexafluoropropylene) as the future material for mesh due to its reduced foreign body reaction compared to PROLENE.[140] In a 2011 interview on mesh erosion conducted by PA consulting group on behalf of Ethicon, Professor Klosterhalfen noted that PP meshes degrade over time, and that Dynamesh, a PVDF mesh manufactured by FEG Textiltechnik, is one of the most stable materials he has seen.[141] Also in 2011, the PA Consulting Group issued a report on mesh exposure in the pelvic floor.[142] They noted that investigation of the causes of mesh exposure is "further complicated by known factors, such as the propensity of polypropylene (PP) to suffer degradation." They further noted that while PP has a long history of use, it is subject to degradation, which has been observed in animal studies. The authors proposed PVDF as an alternative polymer for manufacture of pelvic mesh.

FACTS OR DATA CONSIDERED IN FORMING OPINIONS

The opinions and the bases for those opinions are set forth above. In addition to my knowledge, skill training and experience as an engineer, the following depositions of Ethicon employees and the exhibits thereto were supplied to me: Cliff Volpe, Piet Hinoul, David Robinson, Sunny Rah, Aaron Kirkemo, Sean O'Bryan, Scott Ciarrocca, Vincenza Zaddem, Elizabeth Vailhe, Christophe Vailhe, Joerg Holste, Boris Batke, Daniel Burkley, Thomas Barbolt, Brigitte Hellhammer, Juergen Trzewik, Martin Weisberg, Axel Arnaud, Dan Smith, Prof Thomas Muehl, Dr. Bernd Klosterhalfen, Kevin Ong, Whenxin Zheng,

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the In Vivo Behaviour of Polyvinylidene Fluoride and polypropylene Sutures Used in Vascular Surgery. *ASAIO Journal* 44:199-206, 1998.

[137] Compositional and Failure Analysis of Polymers, 2000, p. 398, 426.

[138] U Klinge, B Klosterhalfen, AP Ottingerc, K Junge, V Schumpelick. PVDF as a new polymer for the construction of surgical meshes. *Biomaterials* 23 (2002) 3487–3493.

[139] ETH.MESH.01218361.

[140] ETH.MESH .05447475.

[141] ETH.MESH.07192412.

[142] ETH.MESH.07192412.

Daniel Sexton, and Jeffrey Brent.

I have also considered the following material identified in Exhibit B.

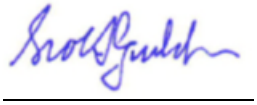
In addition, the following reports were supplied to me: Dr. Howard Jordi, Dr. Russell Dunn, Prof Thomas Muehl, Prof. Bernd Klosterhalfen, Thomas Barbolt, Dr. Wenxin Zheng, and B. Todd Heniford, M.D. The findings of these experts are consistent with my opinions.

COMPENSATION

A fee sheet has been attached as Exhibit C.

LISTING OF CASES IN WHICH TESTIMONY HAS BEEN GIVEN IN THE LAST FOUR YEARS

- IN RE PELVIC MESH AMS LITIGATION, SERRANO ET AL – SEPTEMBER 2013
- IN RE PELVIC MESH ETHICON LITIGATION, HUSKEY ET AL. - MARCH 2014
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, ALBRIGHT ET AL – JULY 2014
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, CARDENAS ET AL – AUGUST 2014
- IN RE PELVIC MESH ETHICON LITIGATION, HUSKEY ET AL – AUGUST 2014
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, BARBA ET AL - FEBRUARY 2014
- IN RE PELVIC MESH BARD LITIGATION, CORRIVEAU ET AL – NOVEMBER 2014
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, FRANKUM ET AL – DECEMBER 2014
- IN RE PELVIC MESH ETHICON LITIGATION, PERRY - DECEMBER 2014
- IN RE PELVIC MESH ETHICON LITIGATION, PERRY – JANUARY 2015
- IN RE PELVIC MESH AMS LITIGATION, KILGORE ET AL - FEBRUARY 2015
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, BARBA ET AL - MAY 2015
- IN PELVIC MESH ETHICON LITIGATION, BRYANT ET AL – SEPTEMBER 2015
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, CARLSON ET AL – OCTOBER 2015
- IN RE PELVIC MESH ETHICON LITIGATION, WAVE 1 – MARCH 2016
- IN RE PELVIC MESH BOSTON SCIENTIFIC LITIGATION, VESTER ET AL – OCTOBER 2016
- IN PELVIC MESH BARD LITIGATION – APRIL 2017



Scott Guelcher, Ph.D.
Guelcher Consulting, LLC